CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

NOVEMBER 1, 1991
VOLUME FIVE NUMBER THREE
SEVEN DOLLARS

COVER STORY:

Manufacturing In Step

Supercharged WANs

John Deere & Co.'s
John Betcher

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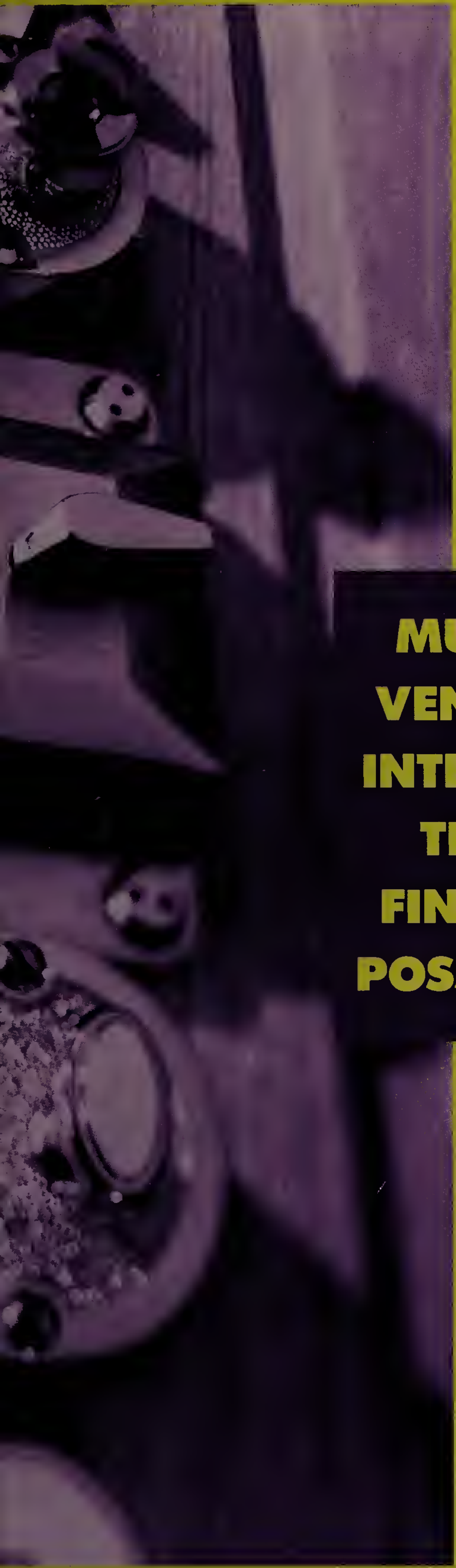

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CIO

VOLUME 5, NUMBER 3

COVER STORY

Concurrent Affairs

30

At manufacturing companies, concurrent engineering is transforming product and production design. But—whether because of culture, tradition or oversight—one potential change agent is taking a back seat in the process: the CIO.

By Allan E. Alter

Manufacturing change **30**
Cover photo of John Betcher
by Russ Munn

FEATURES

Networking on the Fast Track

20

WANs connecting multiple LANs and supporting bandwidth-hungry applications are pushing network throughput capabilities to the limit. Fast-packet technologies can help carry the load.

By Richard Pastore

Technology Talent Scouts

44

Specialized teams scope out the front lines of technology to guide their organizations' executives in strategic decision-making.

By Thomas Kiely

MORE ▶ ▶ ▶

Fast-track
computing **20**

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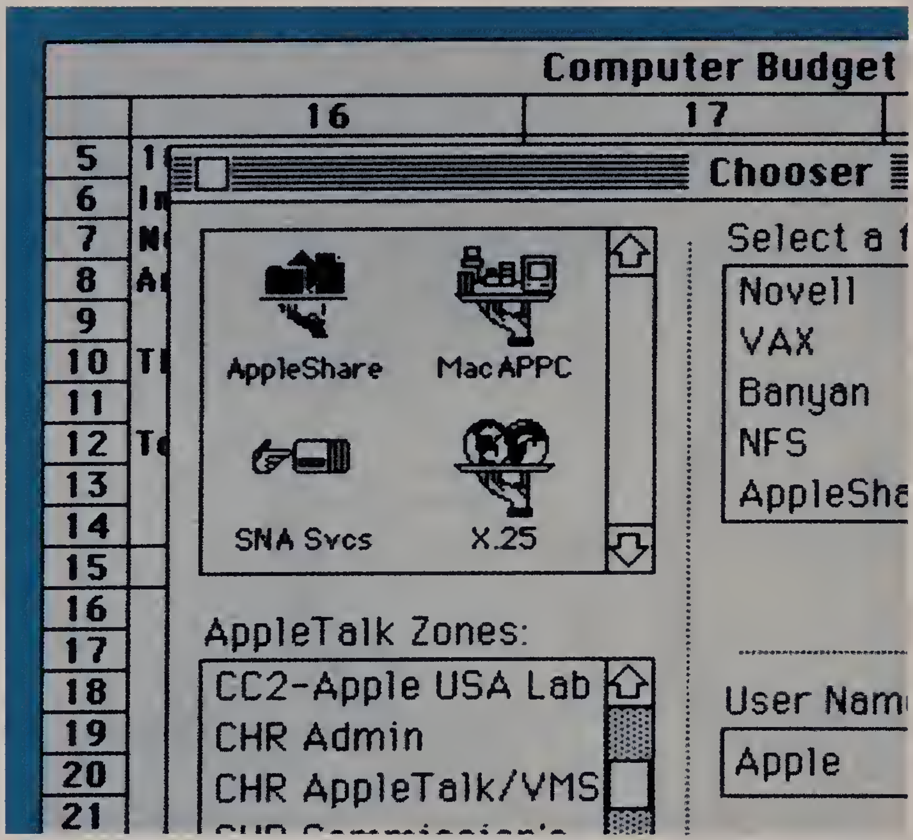
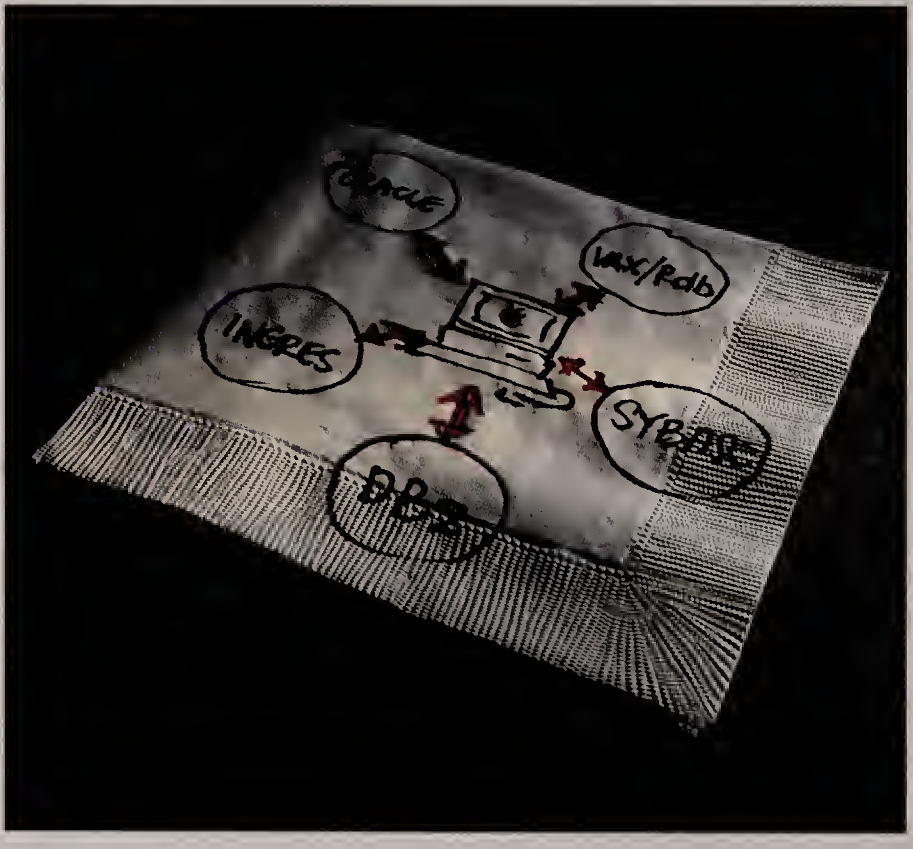
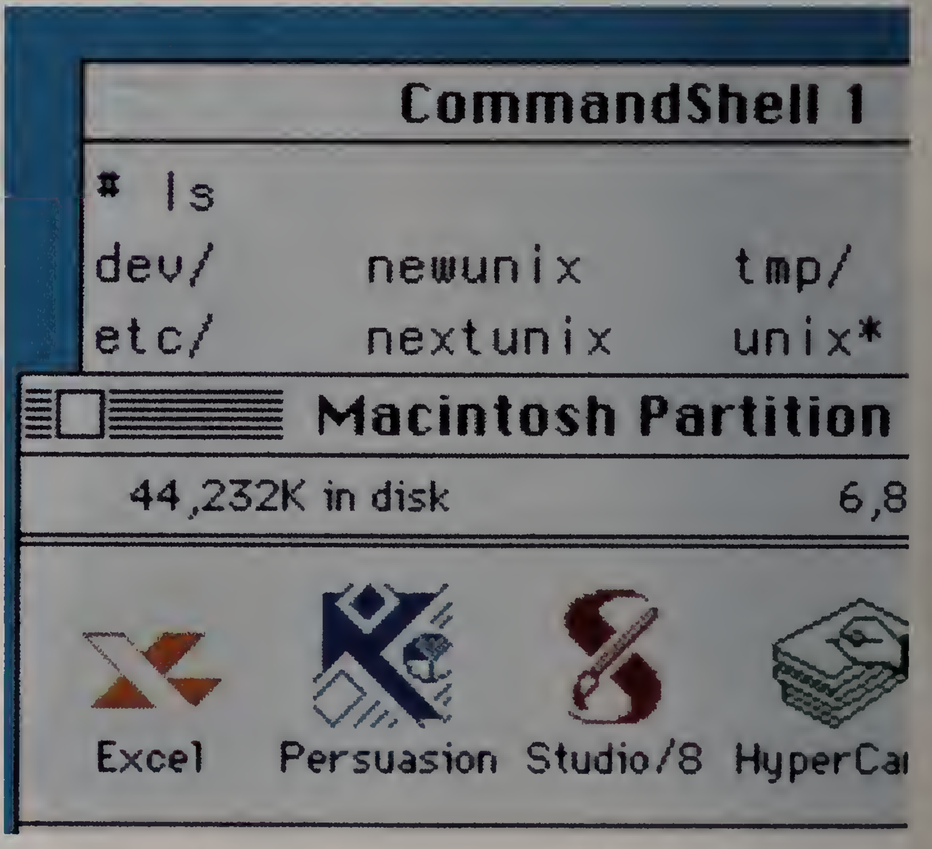


This is the Macintosh Chooser. A single point of access to a wide range of systems. The Chooser shows available network resources graphically and consistently. Just point the mouse and you're connected.

Macintosh offers an incredible range of tools for connecting with virtually any host-based environment, whether it's running SNA, TCP/IP, DECnet™, or OSI.



Apple's Data Access Language (DAL) adapts popular off-the-shelf database, spreadsheet, and data analysis software to major SQL environments. So nontechnical users can easily access remote databases.



```
# ls
dev/       newunix     tmp/
etc/       nextunix    unix*
```

44,232K in disk 6,8

Apple A/UX™ lets Macintosh run UNIX™ applications plus thousands of Mac™ programs. At the same time you can run X-Window and MS-DOS applications, and cut, copy, and paste between any of them. No other desktop computer can do this.

to anything.

Macintosh shares data with DOS PCs via Novell, 3Com, Banyan, and more. Macintosh reads and writes DOS files on a floppy disk. Macintosh runs DOS programs. Maybe your next DOS computer should be a Macintosh.

Information isn't much good to people who can't get to it. Macintosh sorts out the complexities of multiple computer systems and presents vast information to people at the desktop in a single, consistent way.

While diversity may make life rich and fascinating, it makes life as an IS manager something short of serene.

What is politely referred to as the "multi-vendor environment" is an amalgam of disparate hardware, incompatible operating systems, dissimilar databases, and multiple networks. Nevertheless, IS people are expected to make these all work together in perfect harmony.

But lately, a lot of people are finding the source of their solution a pleasant surprise: the Apple® Macintosh® computer.

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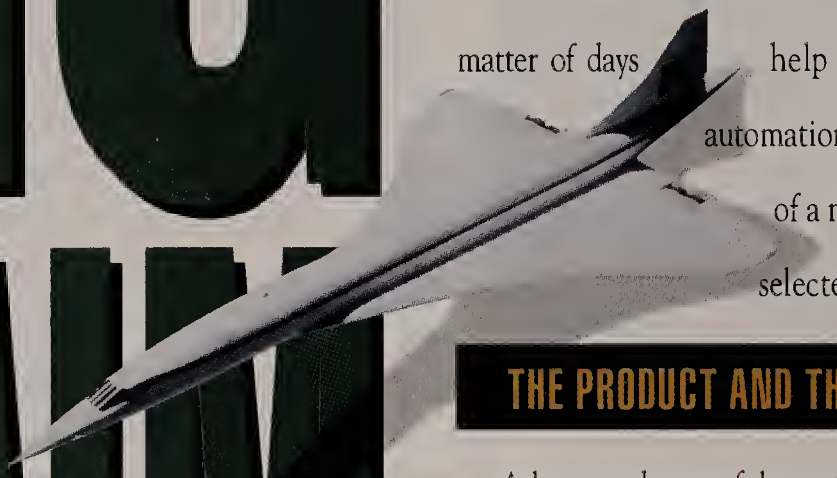

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STATE OF THE ART: TEAMWORK TOOLS 52
Groupware supports the theory that two (or more) heads are better than one.
By Kathleen Melymuka

HUMAN FACTORS: PICKING UP THE PACE 58
The proven success of rapid-development teams suggests that doing a job fast and doing it well don't have to be mutually exclusive.
By Dr. Ronald E. LeBleu and Roger T. Sobkowiak

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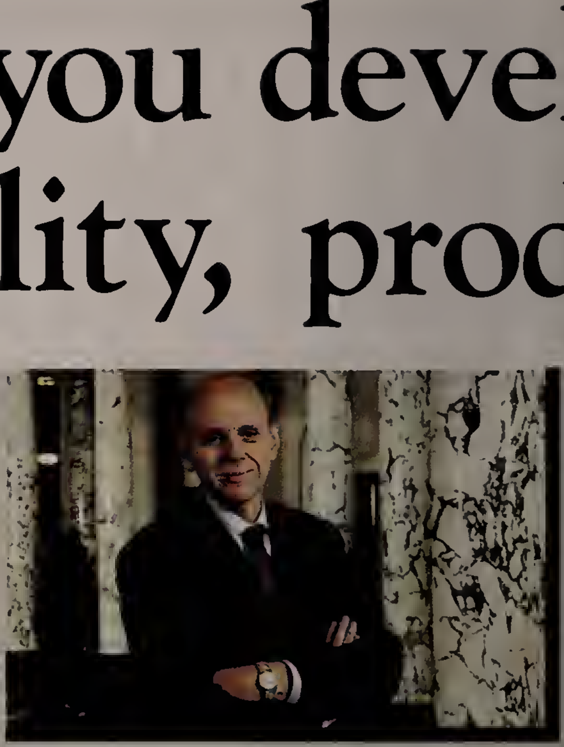
"The IEF is a superior tool for implementing Information Engineering because it integrates the entire process from planning through code generation. We're deploying the IEF throughout the corporation."

David V. Evans
Vice President
Director, Information Systems
J.C. Penney

"Our On-line Banking system has been in production for more than 12 months—500,000 transactions a day—without a single code failure. And we had very few enhancements to do. Our users got what they needed the first time out."

Mark Quinlan
Senior Programmer/Analyst
Huntington National Bank

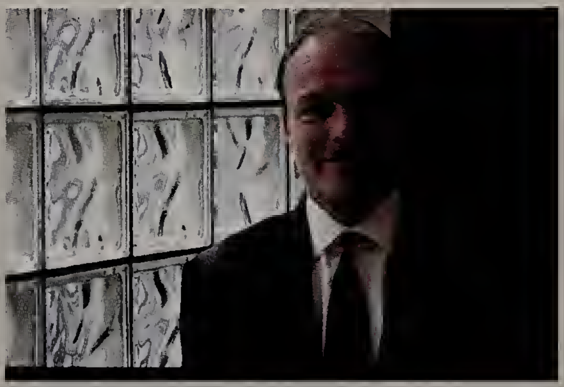


"To meet the dramatically reduced time-to-market requirements for our products, we need high-quality systems that can be changed fast. That's why we've chosen the IEF as the CASE solution for our entire organization."

John Pajak
Executive Vice President
Mass Mutual Life Insurance

"The strengths of the IEF are clear-cut. One obvious quality advantage is that application changes are made to diagrams, not code. This ensures ongoing integrity—the specification always matches the executing system."

Paul R. Hessinger
Chief Technology Officer
Computer Task Group



"I've seen other CASE tools fail, so I raised the bar high when we evaluated the IEF. It passed with flying colors. I could not be happier with my decision to adopt the IEF company-wide."

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President
AMR Travel Services

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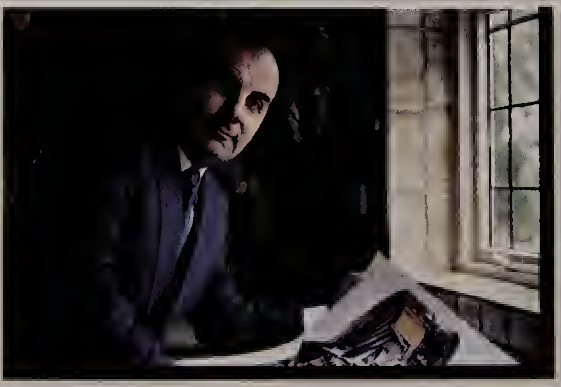
Giorgio Sorani
Division Head – MIS
Lubrizol



"We are using the IEF to develop a new generation of manufacturing systems replacing over 300 existing systems. We estimate that IEF will increase our productivity by between 2-to-1 and 3-to-1 for new systems development.."

Wal Budzynski
Head of Operations, Systems/Computing
Rolls-Royce

"The IEF offers dramatic improvements in productivity, yet it's easy to learn. One example: We trained 23 developers, including 18 new hires, and then completed a large order processing system—300 transactions—all in only 20 months."

Venkat (Vinnie) Tiruviluamala
Director, CPC/CPPC Information Systems
SONY Corporation

"Our first IEF system was completed faster, and with fewer errors, than any system I've ever seen. If I had to go back to the old ways, I'd find another job...outside the DP world. It means that much to me."

Mogens Sorensen
Chief Consultant
Nykredit (Denmark)

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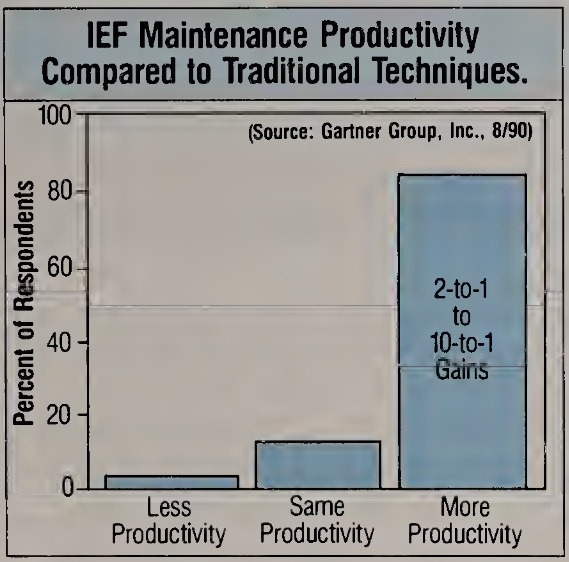
The quality of IEF-developed systems is remarkable. In recent CASE research by The Gartner Group, application developers were asked to report the number of abends they had experienced. (An "abend" is a system failure or "lock-up" caused by code defects.) *IEF developers reported zero defects—not one abend had occurred in IEF-generated code.*

Maintenance productivity gains of up to 10-to-1.

In this same study, developers were asked to compare IEF maintenance productivity with their former methods. Of those responding, *more than 80 percent had experienced gains of from 2-to-1 to 10-to-1.* (See chart.)

Specifications always match the executing application.

With the IEF, application changes are made to diagrams, not code. So, for the life of your system, specifications will always match the executing application. The Gartner Group research showed that *all* IEF users who reported making application changes made *all* changes at the diagram level.



Developers were asked to compare IEF maintenance to former methods. Of those responding, more than 80% reported productivity gains of from 2-to-1 to 10-to-1.

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We are committed to standards.

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LETTER FROM THE EDITOR

PHOTO BY WEBB CHAPPELL

The difficulty of integrating the automated manufacturing operation with the information systems group has been a perpetual thorn in the sides of CIOs of manufacturing companies. With the increasing pressure to bring products to market with lightning speed and to share data throughout the organization, it might be expected that seamless cooperation between IS and manufacturing would be imminent.

No such luck. The advent of concurrent engineering, a cooperative effort linking various engineering functions, again demonstrates the chasm that exists between the IS and engineering disciplines. But progress is underway. In our cover story, "Concurrent Affairs," beginning on Page 30, Special Projects Editor Allan E. Alter examines the argument that IS should become involved in the concurrent-engineering loop much earlier than is currently common practice. IS executives point out that IT enables the process that allows engineers to work cooperatively and that information management views the business as a total system that could help focus the concurrent-engineering effort from its inception. Not so, argue engineers; manufacturing involves process change, and it is futile to develop information systems until processes are agreed upon.

Arguments aside, a lot of the controversy boils down to cultural differences. Historically, one expert advises, animosity exists between IS professionals and engineers because both are technological power brokers within organizations. Moreover, engineers see themselves as creative types, preferring to work on their own during the early draft process. They view information systems people as standards-setters and streamliners.

The causes of this mutual distrust should have a familiar ring to the IS organization, which formerly relished its own exclusivity. But in recent years, the success of the IS effort has been measured by its ability to identify with the business needs of the corporation and to forge greater cross-functional cooperation.

Federal-Mogul is one company that is working hard to bring information systems and engineering closer together. The success of one of its efforts was partly due to the personal style of IS manager Larry V. Smith, who headed up the project. Smith stressed people and process rather than technology, avoiding divisive issues by positioning the effort as a business system rather than an IS or engineering system.

In order to resolve the lingering challenge of bringing the IT and engineering worlds closer together, CIOs must create an atmosphere conducive to effective communication and team building. The people skills required to maneuver through corporate quagmires are the essence of the job. The bits and bytes, while important, will take care of themselves.

Marcia Blumenthal

CIO

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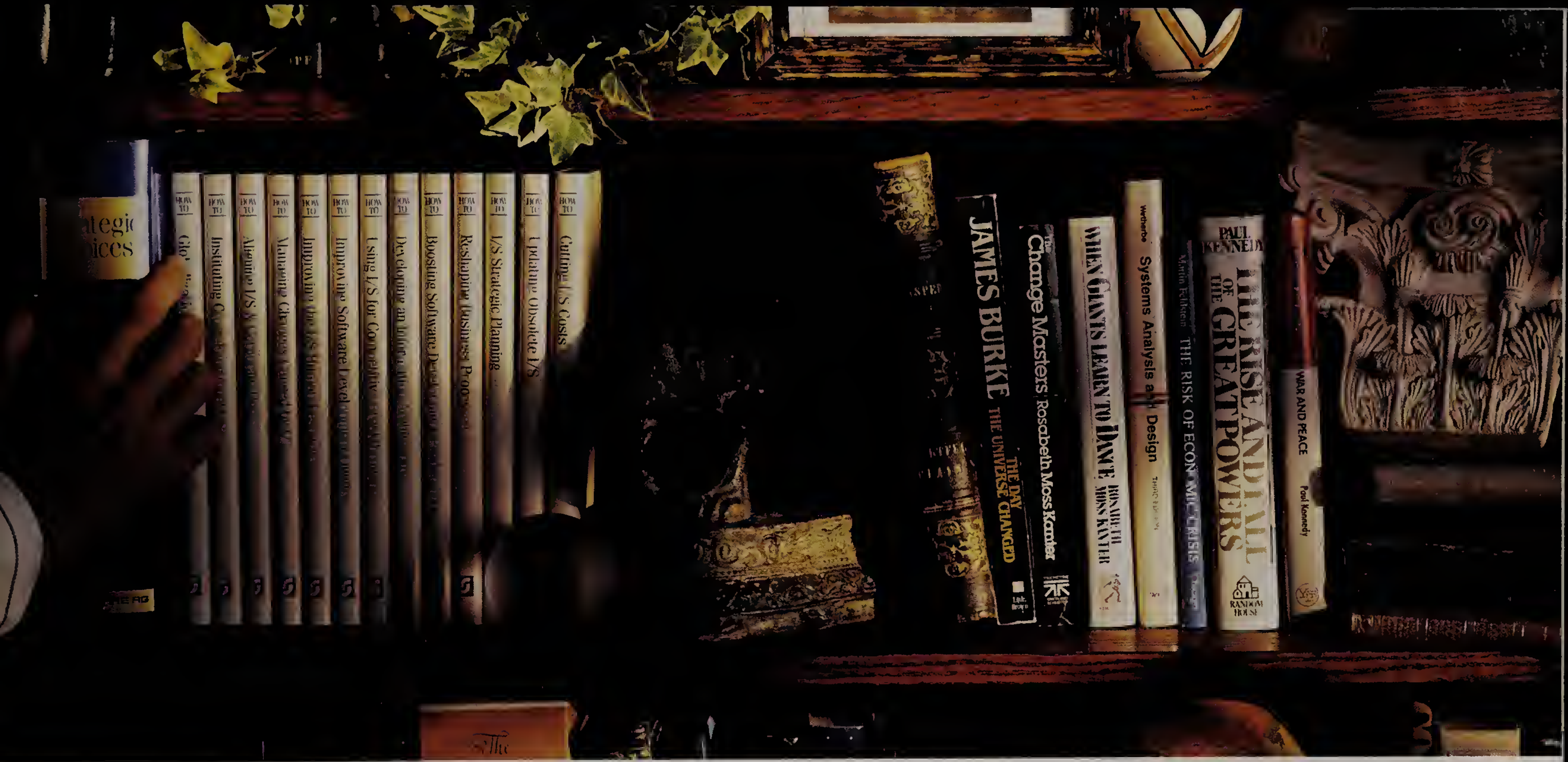
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This fall, *CIO* Magazine celebrated its fourth anniversary. The occasion was marked with an increase in the magazine's publishing frequency, from 12 to 18 issues annually. We made this change based on your feedback: You told us that you wanted more information from *CIO* during your critical planning months of April, May, June, September, October and November.

Increasing the magazine's frequency of publication was one of the biggest challenges we've faced since launching *CIO* in 1987. Every member of the *CIO* editorial, business and production team considered it critical that we achieve this objective without sacrificing the quality and level of information you've come to expect from us.

Many of you have already called or written to me with favorable comments on the frequency increase. In particular, you've told us you like the new "Strategic Outlook" sections, which focus on key issues you're dealing with in your organizations.

As we approach the end of 1991 and look ahead to meeting your needs in our fifth year, I welcome your views on *CIO*'s increased frequency and the editorial content of the magazine. Your continued input, in combination with several readership feedback initiatives, will help us to continually improve the magazine and ensure we're meeting your evolving needs.

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Strategic Outlook: Managing Change

CIO's exploration of how companies handle significant change includes profiles of Continental Bank Corp., which has transformed itself from a full-service bank to a specialized financial institution; Tellabs Inc., whose embracing of JIT and TQM necessitated a reforming of the corporate culture; and CompuCom Systems, which treated efficiency problems by revamping its distribution process.

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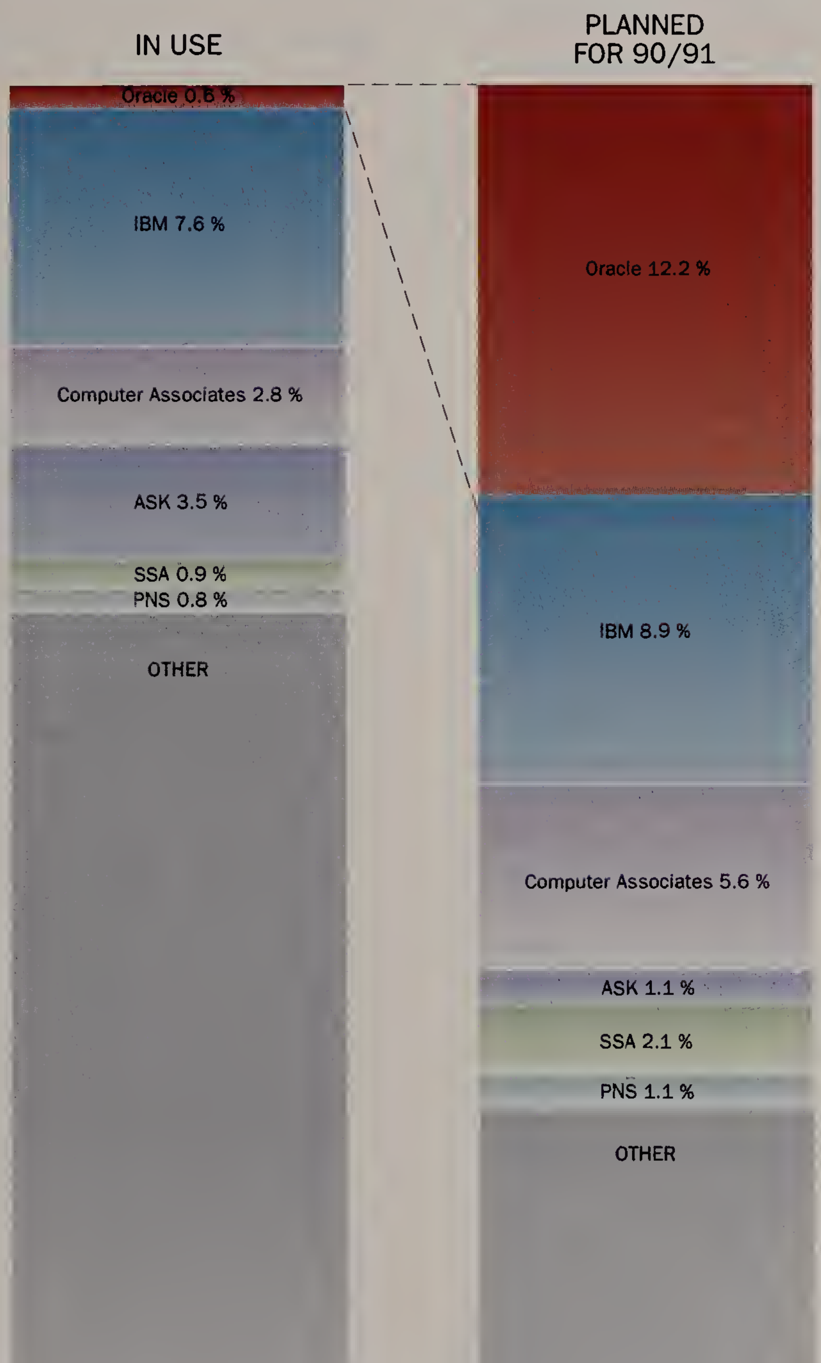

Brands cited when 4,062 Datamation Magazine subscribers were asked "Do you have in use now, or do you plan to use initially in 1990/91, Financial/Accounting software with your minicomputer/workstation system?*

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TRENDLINES

MARINE TECHNOLOGY

THEY'RE LOOKING FOR A FEW GOOD BOOKS

Thanks to technology, members of the U.S. Marine Corps can browse through the stacks of their Virginia research center from the halls of Montezuma to the shores of Tripoli.

The Corps' new information storage and retrieval system, called On-Line Books, stores the equivalent of a 234,000-volume library. With a computer and modem, a marine anywhere in the world can scan the electronic card catalog listing the Marine Corps University's voluminous war-fighting collection. Using hypertext to search and select information, users can either request a hard copy or have the information sent via E-mail to any mailbox in the Corps' worldwide network—which has won for the Marines the top honor in the 1991 ENNE Awards (see related story, Page 16).

With a data depository containing papers, maps, oral histories, speeches and live film footage, customized multimedia CD-ROM diskettes can be produced within hours in support of specific missions.

According to Col. William Pedersen, director of the Marine Corps Central Design and Programming Activity, which developed the system, On-Line Books "is the only electronic library of its kind in the world able to both view and mail full text."

The heart of On-Line Books is the Storage Machine, developed by FileTek Inc. of Rockville, Md. The mainframe-attached, optical-disk-based network server is capable of handling scanned text, graphics, audio and video. The worldwide network includes six IBM 3090s and 25,000 PCs connected via LANs, which are linked to Marine headquarters in Quantico, Va., by leased lines and satellite transmission.

On-Line Books was developed to bring the research center's resources to marines worldwide. Pedersen believes it can serve as a prototype for non-military institutions as well. "The marines, always first to fight, take great pride in spearheading the educational revolution at the edge of the 21st century." ▬

ILLUSTRATION BY JAMES KACZMAN

A WELL-VERSED READERSHIP

The skills necessary to create lines of code and lines of verse are apparently not so different after all. No sooner had our request for CIO-composed poetry appeared in print ("Buddy Can You Spare a Rhyme?" *CIO*, Sept. 1, 1991) than we were bombarded by bards.

Some composed poems specifically for the contest while others sent in packets of verse they had been hoarding for years. We received haiku and limericks, free and blank verse, songs, odes and elegies. Although the work we received reflected a wide range of feeling and experience, we restricted our selection to poems on the subject of information systems. Even in that limited area, entries ranged from profound meditations on the insignificance of technological mastery in the grand scheme of things ("this glowing community of machine activity/and how it ranks among man's endeavors/to work, to love and to find peace for all") to unabashed boosterism ("solved by close cooperation/advantage makes the business grow/brings on pure exhilaration/great to be a CIO").

Choosing a single winner was difficult, but we finally settled on one poem that we felt most eloquently expressed the frustrations of the artist trapped in a businessperson's world. (All entrants will, of course, receive one of our coveted mugs, ideal for storing quills or sipping absinthe.) Here, then, is the winning entry from *CIO*'s own PC Bysshe Shelley: Duane Beard, manager of IDS for Product Development Corp. in Denver.

UNTITLED

Gentle Persons: Torn like the foster mother of Romulus,
Am I huntress wolf or for the man child care?
Do metaphor and imagery peek and poke among the strings?
Can loops repeat with elegance and ends resolve begins?
As manager of info sys and database design, these questions
Rend my other self, the muse will not decline.
For years I've been to social friends a poet, "How does he eat?
Can rhymes provide a table set, supply a winter's heat?"
In business logic rules and old boys cock their heads,
"This memo feels a little strange,
It flows along, quite nice."
How can the two selves reconcile? This next I should resist,
Can muse and logic coexist I ASCII?

AND ATMS WON'T BREAK YOUR LEGS

When is a debt not a debt? When it's incurred by withdrawing money from an ATM located in a gambling casino.

A recent *Boston Globe* article related the strange story of Richard and Michelle Kommit of Brookline, Mass., who in 1988 withdrew $5,500 from an ATM in an Atlantic City casino, presumably lost it at the gaming tables, then reflected upon their bad fortune and decid-

TRENDLINES

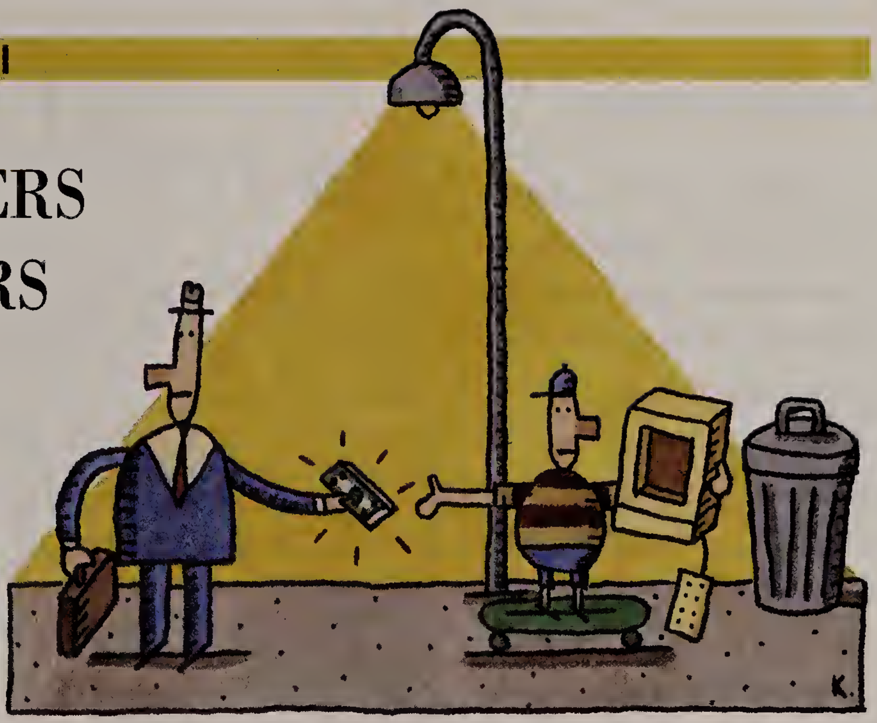
ed not to repay the loan. The strangeness lies in what happened next. The Kommits went to court in Massachusetts, relying on old anti-loan-sharking laws on the books there and in Connecticut (where the couple's credit-card bank is based), which stipulate that "a contract to pay money knowingly lent for gambling is void." The Massachusetts Court of Appeals saw it the Kommits' way and agreed that the debt is uncollectible because siting an ATM in a casino is "knowingly" offering to lend money for gambling.

The bank is contemplating an appeal. The *Globe* article quoted a spokesman for the Casino Association of New Jersey, who raised the specter of people from Massachusetts coming to Atlantic City to "steal from their banks and say they lost the money gambling." And William Meyer, a Boston-based attorney who specializes in banking law, expressed concern about the "absurd" results of applying archaic laws to present-day electronic banking. "This case points up the need to rewrite [the laws to] reflect current realities."

We assume that in the meantime, casino-based ATMs are temporarily out of service.

COMPUTER SAMURAI

WHEN HACKERS HAVE BACKERS



Mercenary hackers are prowling the electronic alleyways—and white-collar professionals are paying for their services. The Sept. 19 issue of *Rolling Stone* magazine featured a report by freelance writer Lynda Edwards on the activities of two such hackers. Referring to themselves as "samurai" (after the aristocratic Japanese warriors), teenage hackers have begun to job out their talents. The article asserts that these Silicon Age samurai have found a nice niche in the corporate world, servicing lawyers and executives who seek access to information locked in a coworker's or supervisor's computer.

One of the hackers profiled in the article, 18-year-old Dex, earned $75 an hour helping an executive from a small advertising agency outside New York break into the computer of the agency's director. (Dex got the job as a referral from a fellow hacker who had seen the executive's message posted on an underground electronic bulletin board.) The ad executive, who headed a team that was competing with rivals within the firm, feared that he had been betrayed by his boss, who was able to monitor E-mail and personal files throughout the company. Dex hacked into the director's computer and downloaded the evidence of interoffice espionage.

Computer (or telephone) monitoring in the workplace is a controversial issue, the author noted, but the law favors the employer's right to monitor over the employee's right to privacy. Edwards suggested that "a hacker may be the only recourse against such monitoring."

But hackers are an anarchistic breed. Dex's fellow samurai, Jack, claimed that he earned $3,000 from a lawyer employed in the New York office of a West Coast firm. The lawyer, who was in competition for a partnership, knew that the partners were using human-resource management software to help assess candidates; he wanted to know what the partners thought of him and his competitors. As the hacker recounted this assignment to Edwards, she reported, he fired up the personal computer in the rec room of his parents' home and broke into the law firm's computer once again. The firm's dirty electronic mail rolled across the screen—including the notes the lawyer had paid Jack to copy.

Edwards noted that these hackers are unimpressed by the suit-and-tie princes who employ them—referring to them as the "Stupids." Said one samurai hacker: "Hey, they really are stupid. I know! I've scoped their PCs, read their E-mail, listened to their voice mail. . . . But they have money—and I need something to do."

COVERING ALL THE (DATA) BASES

Lost data is tangible property and is therefore covered by property-damage insurance, a Minnesota appellate court has ruled in a recent precedent-setting case.

The August issue of the *Computer Law & Tax Report* detailed the case of Retail Systems Inc. versus CNA Insurance Companies. Retail was sued for damages by the Independent Republican Party after a tape containing the results of a voter-preference survey disappeared while in Retail's possession for processing. When Retail attempted to transfer the defense to its insurer, CNA refused on the grounds that the policy denied coverage.

The policy provided coverage for claims resulting from the physical injury or destruction of tangible property. In its ruling, the court held that the data was of permanent value and was completely integrated with the physical property of the tape. Consequently, the data was determined to be tangible property, and the court ruled in Retail's favor.

ILLUSTRATION BELOW BY FRAN O'NEILL; ABOVE BY JAMES KACZMAN

TRENDLINES

EXCELLENCE IN NETWORKING

Enterprise has been a valued part of the national character since before the days of Horatio Alger. Now enterprise networking is also getting the respect it deserves. Last month Network World and Networld '91 announced the winners of the 1991 ENNE Awards for excellence in enterprise networking.

The first ever Grand Partner Award went to the U.S. Marine Corps for a minicomputer WAN that has sites in the U.S., Europe, Japan, the Philippines, Korea and Saudi Arabia. The network has 600 servers worldwide and proved effective in delivering critical data during the Gulf War.

At Grand Metropolitan PLC of Minneapolis, which received the Global User Award, a new networked computing system has reduced the order and delivery cycle, drastically cut time to market for new products and reduced order and delivery errors 30-fold.

Holiday Inns of Memphis, Tenn., won the National User Award for improvements to its Holidex system for booking room reservations and related transactions. In the category Regional Users, Household International of Northbrook, Ill., achieved its goals of approving wholesale mortgages within 48 hours and general financing within 15 minutes. Systems Support Inc., of Northfield, Mass., received the Enterprise Integrator Award. At press time, no winner had been announced in the Single-Site User category.

AUTO INSURANCE

THE QUICKER FIX

The accident that left a dent in your car doesn't have to leave a dent in your time as well. An imaging tool from Image Data Corp. of San Antonio is helping to reduce the time it takes for insurance companies to appraise damages and body shops to make repairs.

Insurance giant USAA is using Image Data's Photophone to trim three days from the inspection/repair cycle, eliminate downtime for body shops and improve customer service. Photophone sends and receives gray-scale and color-realistic images over standard phone lines. Repair shops capture images of damaged vehicle parts with a camcorder and then use the imaging tool to transmit them to USAA's claims department, allowing the company to rapidly review claims.

Photophone is especially useful for handling supplemental claims—estimates submitted by body shops to repair damage undetected in the original appraisal. Such claims are common, since internal damage is often difficult to identify and appraisers lack the time and on-site equipment necessary to disassemble heavily damaged vehicles.

"Before the Photophone, the body shop would call our office and request a reinspection," said Lettie Garza, appraisal office coordinator for USAA. "We then would pull the original estimate and assign an appraiser. By the time the appraiser drove to the body shop the next day, inspected the vehicle and completed the paperwork, at least two days [would] have passed."

Now if a mechanic discovers additional damage, the service writer simply takes a few pictures, plugs the recorder's video output into the imaging device and presses a button on its keypad. At the other end of the line, USAA can approve the new claim in minutes.

"People are very funny about losing their car for a day just to have someone drive out here and spend about three minutes inspecting it," said Wayne Baker, owner of Alamo Body & Paint, one of the body shops that is using the system. "With the Photophone, this doesn't happen."

PHOTOPHONE *helps insurance companies put drivers back on the road faster.*

FROM HUN TO HONEY

The Amoral Eighties seem to have given way to the Nicer Nineties, in which sensibilities finer than Attila-like rapacity are apparently trying to flourish. How else to explain a new quarterly publication that addresses itself to business ethics?

Published by the Forum for Policy Research at Rutgers, the State University of New Jersey, the *Corporate Conduct Quarterly* offered its inaugural issue last summer. The entire contents were devoted to the need for businesses to design and administer effective programs to induce employees to behave lawfully in the course of their jobs. No such carrot being complete without a stick, what makes this topic compelling and timely are tough new federal guidelines for sentencing responsible executives of organizations convicted of criminal misdeeds. And the possibility of sentencing leniency depends to a large extent upon whether organizations have demonstrably "effective" compliance programs in place.

Besides an overview story, the issue includes pieces on what constitutes an effective compliance program, how to audit corporatewide compliance and how business schools can add compliance education to their curriculums. There are also a review of a book on corporate internal investigation and a section of compliance-related news briefs.

Subscriptions are $50 a year. For further information write to *Corporate Conduct Quarterly* at 401 Cooper Street, Camden, N.J. 08102.

ILLUSTRATION BY FRAN O'NEILL; PHOTO COURTESY IMAGE DATA CORP.

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CIO CONFERENCE

SYSTEMS FOR THE FASHION-CONSCIOUS

TOM PETERS *(above) warned of the coming importance of "fickle systems." Panelists addressing the workplace skills crisis included (l.-r.)* **THOMAS WILLIAMS, MITCHELL FROMSTEIN** *and* **JAMES VAN ERDEN.**

PHOTOS BY GINA TARO

Management guru Tom Peters told a packed audience of IS executives in Monterey, Calif., that they'd "better be designing fickle systems." Peters, the keynote speaker at *CIO* magazine's September conference, "IT and the Corporate Agenda: People, Productivity and Profit," prophesied that all goods and services would become commodities, and that markets would be dominated by companies that have realized the power of fashion. Citing the spiraling value of such "intangible assets" as brand name or market image, Peters argued that even markets for financial services and grinding wheels will come to resemble image markets such as those for designer jeans and cross-training shoes.

To survive, organizations must become small, tightly focused and entrepreneurial, said Peters. There is no room for hierarchies or complacency. Companies must also learn how to take risks that reflect the fickleness of image markets. IS executives will be hard-pressed to design systems for these organizations. "I don't know what fickle systems mean. That's your problem," Peters said.

Over 360 IS executives attended the three-day conference held at the Del Monte Hyatt Regency. They heard from numerous speakers on the challenges facing CIOs, who are under increasing pressure to provide measurable productivity and ROI. Moderator Alan Fusfeld, president of The Fusfeld Group, opened the conference by urging CIOs to become catalysts for productivity rather than mere analysts.

CIOs are seduced by crises, argued Robert Zawacki, professor of management and international business at the University of Colorado. According to his research on the psychological aspects of IT, developed with IBM, today's technologists are ill-suited to cope with change. IT executives "are change agents if [the change] is their idea. Otherwise, they obstruct change," he said. Zawacki touched on such change issues as the need for organizations to develop separate, non-managerial promotional tracks to motivate technical staff.

Such changes are necessary because good technical staff will be more difficult to find in the years ahead, according to a panel on the workplace skills crisis, moderated by Michael Behar of University Communications. Panelist Mitchell Fromstein, president of Manpower Inc., urged attendees to "look to the necessity of creating a learning culture in your organization," in order to retain and retrain existing employees to work in a knowledge-based world. Hyatt Hotels Corp. Senior Vice President John Biggs also emphasized education and training as the key to his company's successful move to open systems and vastly improved customer service.

In separate sessions, Ray Lane, senior vice president for Booz-Allen & Hamilton, and Stuart Reeves, senior vice president at EDS, urged CIOs to reexamine conventional notions of business capability and leadership. Citing American Airlines' Sabre system, Lane called for the creation of "market-driving" rather than market-driven systems.

Graham Beachum, vice president of Tandon North America, told a luncheon crowd that accounts of unrealized PC productivity in the workplace were greatly exaggerated. The problem is not productivity, he said, but payoff; most companies have yet to apply technology effectively in creative executive decision making that can affect performance and competitiveness.

Creative decision making has taken on new significance in the modern economy, argued a panel that included Dan Stanzione, president of Operations Systems for AT&T Network Systems. Technology will play a vital role in providing a new breed of customized, high-quality products very quickly and efficiently. Peter Schuyten, editorial director of Dow Jones/News Retrieval, discussed the role that effective and broad-based information delivery plays in such an endeavor.

Sessions by Technology Investment Strategies, Exide Electronics, EDS, Hewlett-Packard, Texas Instruments, Hitachi Data Systems and Computer Associates International covered a range of topics from open systems and EDI to enterprise excellence and customer service.

Arthur Miller, Bruce Bromley Professor of Law at Harvard Law School, spoke on the issue of employee privacy versus corporate privilege, and Mike Vance, chairman of the Creative Thinking Association of America, closed by urging CIOs to take advantage of the emerging creative corporate culture, applying people and technology to compete more effectively. ■

CHANGING HANDS

The European offices of The Diebold Group, the technology and management consultancy founded in 1954 by John Diebold, has a new owner. In early September, debis (an acronym for Daimler-Benz InterServices) Systemhaus GmbH, a subsidiary of Daimler-Benz InterServices AG, purchased the majority of shares of Diebold's European operations. Diebold, chairman of the firm's North American activities, will become a member of the shareholders' board of Diebold Deutschland GmbH, and Gerhard Adler—a 20-year Diebold Group veteran—will remain responsible for all Diebold European companies. Debis Systemhaus provides an array of information technology products and services. ■

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> Within the next 10 years, both the structure of organizations and the jobs of the senior people within organizations will be drastically changed, primarily because of information. This will require information responsibility from everybody, especially from senior management.
>
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THE MAGAZINE FOR INFORMATION EXECUTIVES

NETWORKING ON THE FAST TRACK

WANs connecting multiple LANs and supporting bandwidth-hungry applications are pushing network throughput capabilities to the limit. Fast-packet technologies can help carry the load.

BY RICHARD PASTORE

The new wide-area networking technologies—frame relay, cell relay, SMDS and the rest of the fast-packet cast—have gotten more hype than some of this fall's new TV series. Despite all the publicity, though, CIOs could still use a WAN version of *TV Guide* just to sort out the players. What would be even more helpful are explanations and examples of how these new technologies can impact the organization and the bottom line.

Unfortunately, evaluating fast packet is a little like trying to describe the plot line of last year's *Twin Peaks* after seeing only one or two previews. "The biggest problem [in trying to make an assessment] is the lack of network-analysis software that simulates frame relay, cell relay and these other new services," said Phillip Evans, senior adviser to the International Communications Association and director of telecommunications at FMC Corp., a diversified manufacturing firm in Dallas. "The best way to find out about them is to talk to people who've done it. Unfortunately, not many have."

The first thing to get straight is that fast packet is an umbrella term for several technologies and services. Like traditional packet switching,

PHOTO BY DAVID POWERS

JOHN MATTHESEN: *"Bandwidth on demand is great because you pay for it only as you need it."*

these techniques divide data into packets or cells for transmission across WANs. Where they differ from traditional packet switching is in their use of error-control coding. Fast packet dispenses with much of this coding, trusting instead in high-quality lines and intelligent nodes and servers to keep transmissions clean. Removing this coding overhead from each packet reduces processing time by a factor of 10 compared with regular packet switching.

Error-correction coding was wasted on The Travelers Insurance Co., of Hartford, Conn., one of the first firms to implement fast packet. "Our backbone is all fiber, so there was little error in it," explained Travers Waltrip, vice president of telecommunications. "By eliminating that error correction, we were able to get more usable bandwidth." Travelers began replacing its IBM Synchronous Data Link Control gateways with frame-relay split bridges over a year ago. The result was an increase in usable bandwidth from 56Kbps to 1Mbps.

While at first it seemed like the different fast-packet technologies would compete in a technological version of *Battle of the Network Stars*, today consensus is that each has a complementary role to play.

Frame relay, which begins its major rollout this quarter, is a faster but relatively compatible version of X.25 packet switching. It transmits variable-size packets at speeds up to 1.54Mbps. Cell-relay products and services, which are based on the fixed-size packet standard Asynchronous Transfer Mode (ATM), will not be widely available for at least two years.

One of the first of the ATM cell-

> *Besides speed, the key benefit of fast-packet technology is more efficient and cost-effective bandwidth usage.*

The WAN Fall Lineup

Trying to sort out the various network plots and players can be bewildering at best. Here are this season's highlights.

Asynchronous Transfer Mode (ATM): A how-to show for constructing cell-relay packets, from the standards folks at CCITT and Bellcore. Following ATM guidelines, each packet must hold 53 bytes of data; five must be header information. This uniformity, plus the lack of error-control codes, allows optimized network hardware and software to process ATM packets at speeds greater than 1.54Mbps.

Broadband Integrated Services Digital Network (BISDN): A proposed spinoff of the semi-popular ISDN, this fiber-based network service is not expected to premiere until late in the decade. When it does, its ATM-based switching and multiplexing techniques will propel transmission speeds up to 150Mbps.

Cell Relay: Not to be confused with ESPN's inmate foot-race series, cell relay is fast-packet switching based on fixed-length data cells rather than variable-length packets. WAN hardware can be optimized for the uniform cell size, enabling faster transmission than is possible with more-generic hardware and variable-size packets. The uniformity also makes cell relay appropriate for variable-length, delay-sensitive data such as voice.

Fast-Packet Switching: Like CNN, fast packet presents neatly packaged "packets" of information for transmission. But this WAN technology strips some of the error-control coding to achieve speedier processing. Because error checking is lacking, reliable lines, intelligent hardware and careful congestion management are musts for good reception. Fast-packet techniques also allow users to access as much bandwidth as they need within a given allotment.

Frame Relay: Premiered this fall after preseason trial run. Unlike other, more uniform-minded fast-packet players, frame relay transmits variable-length data packets at up to 1.54Mbps. Best for bursty LAN applications, this interface technology is not intended for variable-length, delay-sensitive data such as voice.

Switched Multimegabit Data Service (SMDS): A public-network program funded by AT&T and your regional Bell operating companies, this cell-relay service may initially be seen only in metropolitan areas. When it debuts later in the decade, it should be capable of transmitting data, including delay-sensitive types, at speeds between 1.54Mbps and 45Mbps.

Synchronous Optical Network (SONET): This transmission standard exists in a futuristic setting in which optical-based WANs whisk data along at speeds as high as 5Gbps. Vendors such as Network Equipment Technologies Inc.'s Adaptive subsidiary are supporting SONET at T3 speeds. SONET is also the standard under which BISDN networks will operate. *–R. Pastore* relay services will likely be Switched Multimegabit Data Service (SMDS), a public-carrier offering that will transmit at speeds between 1.54Mbps and 45Mbps. Even faster ATM-based services and standards will be heard from late in the decade in the form of Broadband Integrated Services Digital Network (BISDN) and Synchronous Optical Network (SONET) (see related story, Page 22).

What's driving such speeds is the surge in WAN traffic as more firms interconnect LANs. At the same time, bandwidth-gobbling applications such as imaging, multimedia and computer-aided design are finding their way onto LANs, thereby testing wide-area throughput capabilities. These trends will cause the average maximum LAN-to-WAN message burst to increase in size from 32Kb today to 145Kb, or 353 percent, by 1994, according to Vertical Systems Group, a consulting firm in Dedham, Mass.

New LAN applications are one reason Chemical Banking Corp. is evaluating frame relay. "We're looking at implementing imaging, where we'll need to pass large files across the WAN," said Al Tornatore, head of the bank's network planning group in New York. Economics limit the practical bandwidth of X.25, he said. The bank has been studying frame relay for a year and is prepared to implement it if it fits into the grand scheme of the pending merger with Manufacturers Hanover Corp.

ROSEMARY COCHRAN: *Circuit switching alone enjoys a 40-to-1 margin over frame-relay.*

PHOTO BY WEBB CHAPPELL

Besides speed, the key benefit of fast-packet technology is more efficient and cost-effective bandwidth usage. In circuit-switched or time-divisional multiplexed networks, dedicated paths or discrete time periods are assigned along the transmission path, and managers must allocate segments of bandwidth for specific user traffic. These segments are relatively rigid, and it often happens that they go underutilized because of the intermittent or bursty nature of LAN traffic. Bandwidth utilization rates can average as low as 15 to 20 percent, making for a lot of wasted channel. In contrast, fast packet allows traffic from multiple sources to share available bandwidth as needed, free of the shackles of rigid segmentation.

"We don't want to lock up bandwidth for something that maybe runs only at night," said Gary Dong, head of WAN planning at Chemical Bank. Dong said he hopes careful management of frame-relay bandwidth will turn cost efficiencies into competitive advantage over firms that lack fast-packet switching.

"Bandwidth on demand is great because you pay for it only as you need it," said John Matthesen, corporate telecommunications manager at software developer Sybase Inc. in Emeryville, Calif. Sybase pays a public frame-relay service a flat rate for a 256Kbps portion of a T1 pipe. "I'm paying less than I would for full T1 bandwidth," said Matthesen, "but I can access full T1 if I need it."

While it is difficult to forecast fast-packet savings at this stage, early frame-relay users are almost as enthusiastic as call-in customers on the Home Shopping

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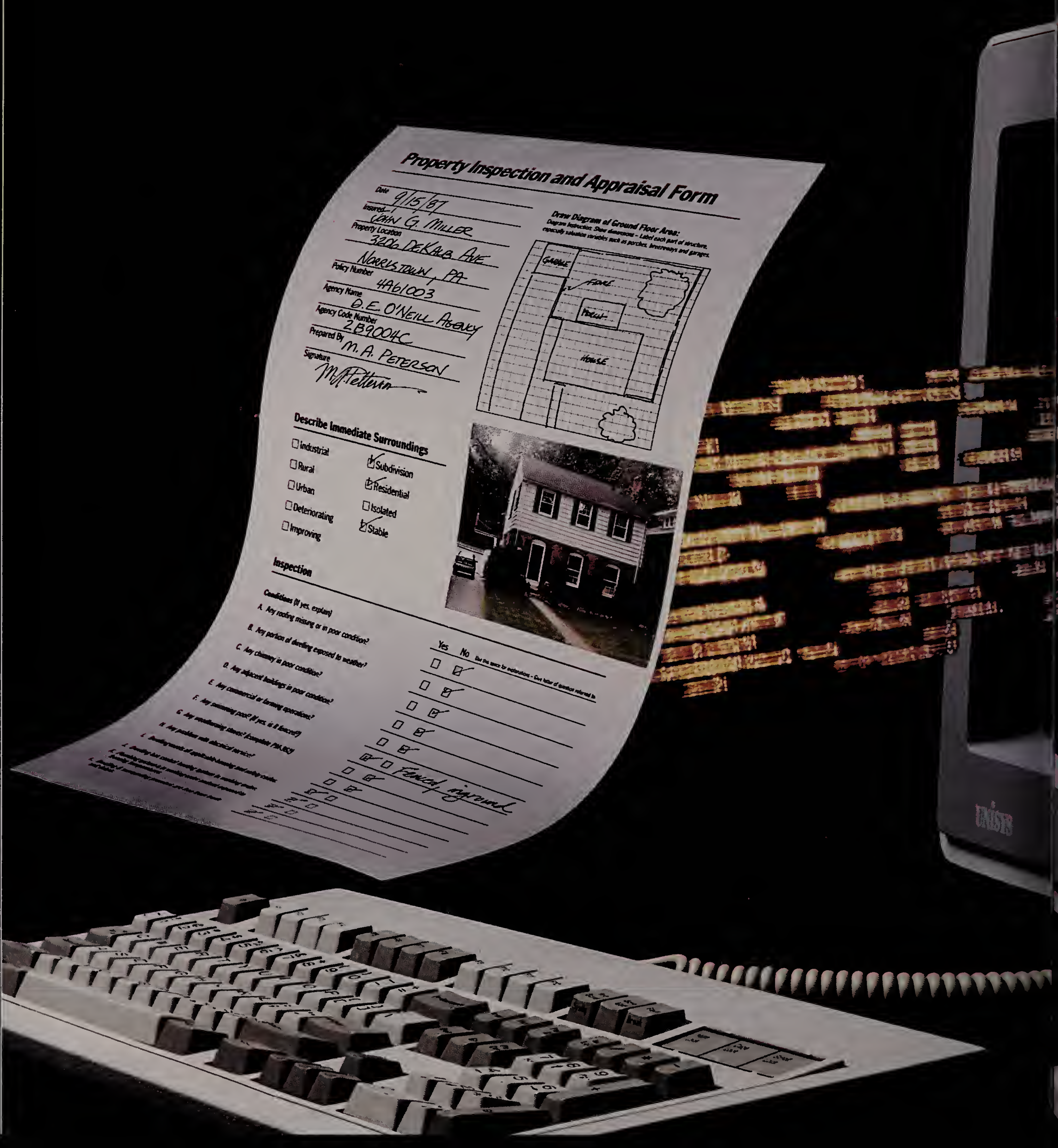


Property Inspection and Appraisal Form

Date 9/15/87
Insured JOHN G. MILLER
Property Location 3206 DEKALB AVE NORRISTOWN, PA
Policy Number 4A61003
Agency Name D.E. O'NEILL AGENCY
Agency Code Number 2B9004C
Prepared By M. A. PETERSON
Signature M.A. Peterson

Draw Diagram of Ground Floor Area:
Diagram Instruction: Show dimensions – Label each part of structure, especially valuation variables such as porches, breezeways and garages.

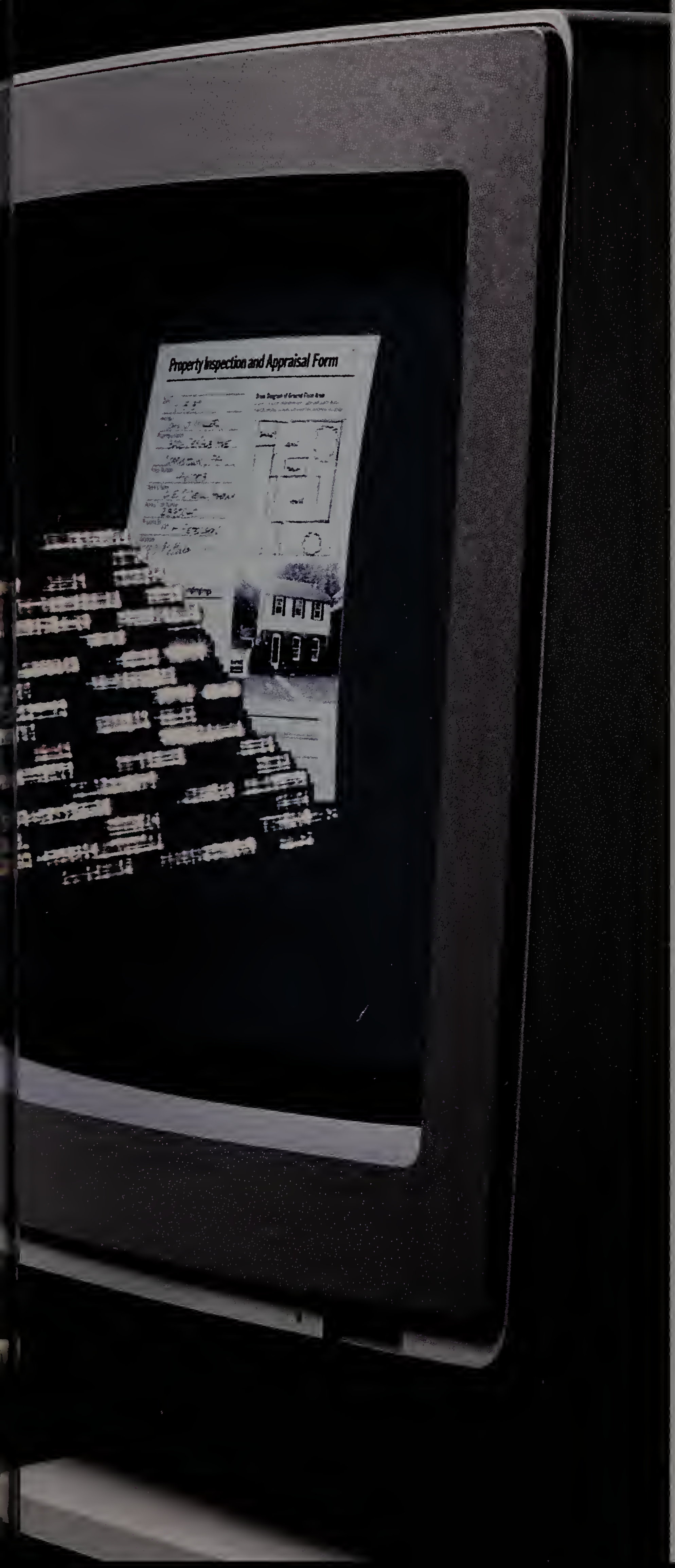
Describe Immediate Surroundings

☐ Industrial
☐ Rural
☐ Urban
☐ Deteriorating
☐ Improving
☑ Subdivision
☑ Residential
☐ Isolated
☑ Stable

Inspection

Conditions (If yes, explain)

	Yes	No	
A. Any roofing missing or in poor condition?	☐	☑	
B. Any portion of dwelling exposed to weather?	☐	☑	
C. Any chimney in poor condition?	☐	☑	
D. Any adjacent buildings in poor condition?	☐	☑	
E. Any commercial or farming operations?	☐	☑	
F. Any swimming pool? (If yes, is it fenced?)	☑	☐	Fenced, inground
G. [illegible]	☐	☑	
H. Any problem with electrical service?	☐	☑	
I. [illegible]	☑	☐	



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Network.

"Immediately upon replacing a point-to-point circuit, we saved over 50 percent in circuit costs," said Coyne Gibson, MIS operations manager at Convex Computer Corp., a supercomputer manufacturer in Richardson, Texas. For every three nodes, Gibson's circuit-switched network required six router interfaces. After installing frame-relay service, that number was cut in half, bringing the approximate cost for any new routers down from $30,000 to $7,000, he estimated. Compared with the old WAN, Gibson said, "we're getting the same relative performance at one-third the cost overall."

This jibes with analysts' predictions of 30 percent savings in transport costs or a two-fold boost in performance if the same number of circuits are maintained.

Frame relay can help corral spending for new lines as well. At Travelers, frame relay is paying for itself in T1 cost savings alone. "It has prevented us from having to put in more T1 carrier facilities to carry the increasing traffic," Waltrip said.

While corporate bandwidth demand rises 50 percent annually at Motorola Inc., based in Schaumburg, Ill., the budget for new lines is not as elastic. Fast packet has helped bridge the budget gap. "Fast packet and other techniques allow us to service that bandwidth growth with only single-digit percent growth in expense," said Les Shroyer, corporate vice president and director of management information systems and telecommunications.

For those sites already invested in X.25 packet switching, the good news is that much of the hardware can be retained and adapted for frame relay, according to Peter G.W. Keen, executive director of the International Center for Information Technologies in Washington. "You can stay with your X.25 environment, and suddenly you're in the bandwidth candy store," he said.

Relatively inexpensive frame-relay software upgrades are available from Netrix Corp. in Herndon, Va.; Stratacom Inc. in Campbell, Calif.; Cisco Systems Inc. in Menlo Park, Calif.; and Xyplex Inc. of Boxborough, Mass., among others. (For instance, Xyplex charges $500 more for its new frame-relay-capable routers and bridges than for comparable products without frame-relay support.) Companies with point-to-point, circuit-switched installations face more costly hardware acquisitions, particularly

TRAVERS WALTRIP: *"With cell relay, you get even more efficiency on digital bandwidth because you're carrying everything—data, voice, fax and image."*

PHOTO BY LANNY NAGLER

frame-relay switches that can cost $9,000 to $15,000 apiece. Partly due to the relatively low upgrade costs and potential for savings, private and public frame relay will comprise 22 percent of all WAN connections for LAN-to-LAN communications in the United States by 1993, according to Business Research Group in Newton, Mass.

> *"Immediately upon replacing a point-to-point circuit, we saved over 50 percent in circuit costs. Compared with the old WAN, we're getting the same relative performance at one-third the cost overall."*
>
> *–Coyne Gibson*

For companies not willing to invest in new hardware, or for those who aren't comfortable boldly going alone where few have gone before, there are a handful of public frame-relay carriers. These will assume some of the capital and management burdens in exchange for a flat monthly fee.

Williams Telecommunications Group (Wiltel), in Tulsa, Okla., claims that its frame-relay service costs half of what a similarly configured circuit-switched system would. A single-line 56Kbps service connecting mesh-configured LANs in New York, Chicago, Atlanta, Dallas and San Francisco would cost $29,400 per month based on AT&T tariffs, including local access charges and discounts, according to Joe Zell, Wiltel manager of market research and product development. Wiltel could provide the same sites with 64Kbps frame-relay service (with

A Users' Guide to Frame Relay

More than 50 vendors swell the ranks of the Frame Relay Forum, a recently created coalition based in Mountain View, Calif., that is pledged to promote the technology, its standards and product interoperability. Of these firms, the following U.S.-based respondents to CIO*'s inquiry said they were shipping end-user frame-relay products as of press time.*

COMPANY & LOCATION	PRODUCTS
Advanced Computer Communications Santa Barbara, Calif. 800 444-7854	Bridge routers
Cisco Systems Inc. Menlo Park, Calif. 800 553-6387	Routers
CompuServe Inc. Columbus, Ohio 800 848-8980	Public frame-relay service
Graphnet Inc. Teaneck, N.J. 800 327-1800	Public frame-relay service
Hughes Network Systems Inc. Germantown, Md. 301 428-5500	Switches
Motorola Codex Mansfield, Mass. 508 261-4000	Switches, multiplexers and packet assembler/disassemblers
Netrix Corp. Herndon, Va. 703 742-6000	Switches
Northern Telecom Inc. Richardson, Texas 800 328-8800	Central office switches
Stratacom Inc. Campbell, Calif. 800 537-7707	Switches
Sync Research Irvine, Calif. 714 588-2070	Assembler/disassemblers
Synoptics Communications Inc. Santa Clara, Calif. 408 988-2400	Routers
3Com Corp. Santa Clara, Calif. 800 638-3266	Routers
Williams Telecommunications Group Tulsa, Okla. 800 642-2299	Public frame-relay service
Zilog Campbell, Calif. 408 370-8000	Serial communications controllers

AL TORNATORE *(left) and* **GARY DONG** *hope that frame relay will give them competitive advantage over firms that lack fast-packet switching.*

PHOTO BY KENT HANSON

burst capacity up to 1.024Mbps) for $14,240, including local-access charges, he said.

Even companies with large private-line installations say they can exploit the public services in locations that don't warrant the expense of private lines. "We expect to use the public services to extend our effectively private network to some of our smaller offices and possibly into home settings," said Motorola's Shroyer. Such hybrid public/private WANs will be dominant in the 1990s, boosting public frame-relay vendors' revenues from $4 million this year to over $1 billion by 1995, according to Vertical Systems Group.

Despite the promising early signs, fast-packet technologies are not for everyone. Companies with small networks would realize little in the way of savings, according to Rosemary Cochran, principal at Vertical Systems Group. "If you don't need more bandwidth or sites and you're getting the throughput you need, there is no justification to change," she said. If the need is simply to eke out some extra bandwidth, companies could try data and/or voice compression as an alternative.

Frame relay has its own limitations. Because the packets are variable in size, the data is subject to variable transmission delays. This makes the technology unsuitable for delay-sensitive data such as voice and video. Also, extremely large packets may occasionally come down the pipe, excluding others and causing congestion. Congestion management is still being worked out by the vendors and early users. As for voice and video, frame-relay users can route them through a separate circuit-switched network or over a dedicated segment of the T1 line.

Cell relay will have the edge over frame relay when it comes to congestion and delay-sensitive data. Since its packet sizes are uniform, cell relay avoids variable delays and the chance of a monstrous packet gumming up the works. Thus, cell-relay services such as SMDS will be able to handle voice and video along with other data. Stratacom's frame-relay switch actually borrows from cell relay in order to handle voice, chopping up variable-length packets into uniform-size cells.

> *"If you don't need more bandwidth or sites and you're getting the throughput you need, there is no justification to change."*
>
> *–Rosemary Cochran*

"With cell relay, you get even more efficiency on digital bandwidth because you're carrying everything—data, voice, fax and image," noted The Travelers' Waltrip. He plans a shift to cell relay sometime after 1995, when need for higher speeds creates economies of scale. Other users are more suspicious about SMDS and cell relay, which have received less vendor support than frame relay and require more expensive hardware changes. Even Waltrip admits the transition to cell relay will be difficult and expensive, since "everything will have to go except the basic fiber plant."

With the rise of fast-packet technology, are its predecessors—X.25 and circuit switching—in danger of obsolescence? Not in the immediate future, analysts say. Circuit switching alone enjoys a 40-to-1 margin over frame-relay installations, according to Cochran. However, market growth for X.25 is already slowing, she noted. And as more-reliable lines span the globe and voice-capable cell-relay services debut, even circuit switching may lose its prime-time slot on the wide area network.

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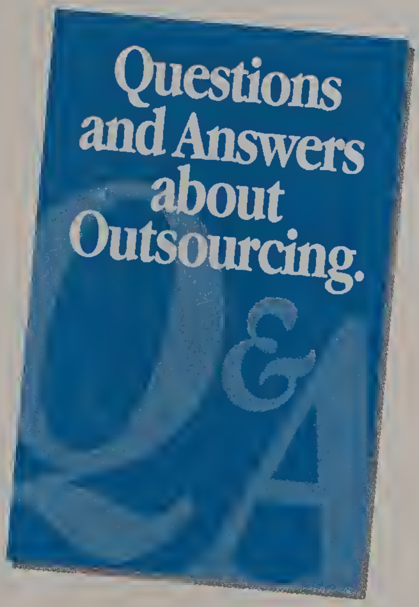

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EX31492

At manufacturing companies, concurrent engineering is transforming product and production design. But—whether because of culture, tradition or oversight—one potential change agent is taking a back seat in the process: the CIO.

CONCURRENT AFFAIRS

BY ALLAN E. ALTER

John Betcher is caught between a grand idea and reality. As manager of computer systems at John Deere & Co.'s Dubuque (Iowa) Works, he's been pulling for concurrent engineering—a new approach to manufacturing that calls for close cooperation, data sharing, ongoing communication and simultaneous effort among all manufacturing functions. Betcher is considered "a key support" in the concurrent-engineering drive by James D. White, the vice president of manufacturing for Deere's Industrial Equipment Division, based in Moline, Ill.

"To IS," said Betcher, "the hardware and software is the least-significant part of concurrent engineering. It's important, but it pales in comparison to establishing an effective team." Yet Betcher is in a bind: IS professionals and engineers don't understand each other well enough to work together as well as he'd like. Better understanding would require interaction from the very beginning of the product-planning process, he said. But IS is not brought into the process until after the product-planning phase is completed. In Betcher's opinion, IS remains under-appreciated and poorly understood, and from the IS viewpoint, the concurrent-engineering effort is less successful than it could be.

Betcher's situation has left him dissatisfied with his division's concurrent-engineering efforts. "In concurrent engineering, people have to be in tune with each other. The problem is, where do you send people to school to get in tune?"

Welcome to the world of industrial cooperation. After a century of sequestering employees in job categories, hierarchies and functional departments, manufacturers seek teamwork, dialogue and barrier-bashing. Many have converted to the concurrent (a.k.a. simultaneous) engineering techniques made famous by the Japanese car companies. Concurrent engineering is much more than collaboration between IS and engineering: It's business-process change, manufacturing style. The traditional approach to manufacturing divides the manufacturing process into a sequence of chronological steps. Product planners, designers, manufacturing-process engineers do their thing, throw their plans over the wall to the next department in line, and move on to another product under development. Concurrent engineering blasts the wall to smithereens. Planners, designers, engineers and assemblers work together simultaneously as a

ED WOJCIECHOWSKI: *"IS facilitates, but we really don't drive this initiative at all."*

PHOTO BY ANDY GOODWIN

JOHN BETCHER: *"Engineers are individualistic, creative folks, whereas in systems you try to standardize and streamline."*

PHOTO BY RUSS MUNN

product team and share ideas, information and feedback from customers and suppliers.

"Sitting together as a group and coming up with the answer is much better than doing it serially, for the same reasons in IS that JAD [joint application design] is more successful than interviewing individuals," said Tom English, vice president of information services at Federal-Mogul Corp. in Southfield, Mich. "You get a better product in a fraction of the time, and costs are bound to be lower. You get everyone together, make decisions and get on with it."

Like any major business-process change, concurrent engineering is no picnic. It requires a major overhaul of the corporate culture. Workers, professionals and middle managers must overcome their fears that change means loss of turf, responsibility, respect and jobs. "I wouldn't recommend it to any organization that isn't willing to go through some restructuring trauma," said White. Notwithstanding the hard work and organizational upheaval, the results can be extraordinary: For example, Cadillac Motor Car Division's capture of the Baldrige Award and the dramatic turnaround at Federal-Mogul's oil-seal business (see related story, Page 36), owe much to concurrent engineering.

In the information age, the importance of IS and IT in furthering teamwork and business-process change would appear to be clear and undisputed. But it ain't necessarily so. In the manufacturing world, there are profound cultural differences and rivalries between IS professionals and design or process engineers. There are strong disagreements over the role of IS. And while today's technology is strong at aiding analysis and communication, it is weak in abetting cooperation and coordination. IS may have a spot on the team, but it often sits on the bench during the first quarter of the game.

"IS facilitates, but we really don't drive this initiative at all," said Ed Wojciechowski (pronounced Woe-jih-how-ski), director of information resource management for Sundstrand Aerospace, in Rockford, Ill. "I go to many conferences where people talk like they drive it, but they don't." Manufacturing or engineering management drives concurrent engineering. In business re-engineering, IS management plays a leading role from the beginning. But in concurrent engineering, opinion is sharply divided over when to bring in IS.

"The IS role [in concurrent engineering] is to enable the simplification of these business processes," said Woody Noxon, director of the Engineering Systems Division of Eastman Kodak Co. in Rochester, N.Y. "IT enables people far apart to work concurrently; they can now share one database, which was not possible a few years ago. The people

Spanning the Chasm

Four ways to build teamwork and trust between IS and manufacturing:

Hire engineers onto the IS staff. This helps IS professionals better understand engineers' needs, according to Ed Wojciechowski, director of information resource management for Sundstrand Aerospace, in Rockford, Ill.

Locate IS support staff with the engineers. IS staffers "live with us, they are in our meetings," said Robert L. Doren, Cadillac Motor Car Division's chief engineer. "It is the only way I know they can figure out what we need."

Build consensus. To ensure engineering buy-in to IS plans, stick to a consensus-building approach even when it is inconvenient, said Tom English, vice president of information services at Federal-Mogul Corp. in Southfield, Mich.

Provide state-of-the-practice, not state-of-the-art, systems. Supply tools that people can really use, and that fit well into your company's working environment, said Woody Noxon, director of the Engineering Systems Division of Eastman Kodak Co. in Rochester, N.Y.

—*A. Alter*

PHOTO BY JACK VAN ANTWERP

TOM ENGLISH: *"Sitting together as a group and coming up with the answer is much better than doing it serially."*

who can enable this to happen should be part of the process. IS should be involved at the start."

Professor Dan L. Shunk, director of the CIM Systems Research Center at Arizona State University in Tempe, cited a National Science Foundation study that shows over 70 percent of the life-cycle cost of a product is defined at the conceptual and preliminary design stages. According to Shunk, IS must play "a dynamic, supportive role" in these stages, by focusing technology-management efforts and providing "feedback systems" and data to the design team. And Reuben E. Slone, the manager of Ernst & Young's Detroit-based Automotive Industry Services Group and a lead consultant to Federal-Mogul's concurrent-engineering effort, argued that IS's way of looking at business as a system can be an enormous help during the early stages of concurrent engineering.

But others say IS should stand aside until new manufacturing processes are well on their way to implementation. "Technology can't overcome inherently bad processes," said George Stalk, the Chicago-based vice president of the Boston Consulting Group who is a consultant to John Deere. Automate prematurely, Stalk warned, and manufacturers will only automate their problems. Executives may even be led astray if IS is brought in during the planning stage—seduced by visions of a technological fix or suckered into buying into the status quo of existing systems. "One client spent $75 million to develop a system tracking engineering change orders," Stalk said. "It does nothing to speed up the [product-development] process. What it did was seduce management to wait until the system is done. That is the biggest cost of leading with information systems."

Cadillac managers concur. It would have been a mistake to build new information systems early in the move to simultaneous engineering, "because we didn't understand the process," said Robert L. Doren, Cadillac's chief engineer. "We would have automated our complexity first, and

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JOE McCUSKER: *"Now that we have our process starting to work as we'd like, we can uncover where IS will really be of value to us."*

PHOTO BY STEVEN BENSON

not done it right." Joe McCusker, whose actual title is champion of simultaneous engineering, agreed. "Now that we have our process starting to work as we'd like, we can uncover where IS will really be of value to us."

When IS does enter the ball game, it faces skepticism and opposition from its own teammates. Cultural differences between IS and engineers—compounded by mutual ignorance, lack of appreciation for IS, and professional rivalry—are the reasons.

"Historically," said Slone, "there's great animosity between the engineering and the IS functions," the two technology powers in a manufacturer. "Here, in the companies around Detroit, IS is viewed as a necessary evil; it's only beginning to be viewed as a strategic resource." Cadillac's Doren lays the blame instead on mutual misunderstanding. "Engineers are trained to be different, and we are different."

And how. "Engineers are individualistic, creative folks, whereas in systems you try to standardize and streamline," said Betcher. Engineers are more willing to work by the seat of their pants and accept uncertainties than are systems people. "Engineers say, 'Why don't you put something together, and if we like it we'll use it.' My mentality is, 'Why don't we work together on what you want, and together we'll build what you need.' " But engineers are less willing to share information, finding it hard to let others have access to drafts-in-progress, for example. "Engineers like to work in private until their work is ready, like artists who don't want to show their drawings until they are done," Betcher said.

Engineers see little value in standardization, said Wojciechowski; they want the best tool for their job. As a result, "the repertoire of tools in engineering departments is enormous." Engineers frequently develop new programs only to discard them when the task is done, and they "tend to be mesmerized by the newest technology," Wojciechowski said. "In some respects, because of our discipline and experience, we are the ones that hold the lines on standards. We appear to be an impediment to progress."

Yet engineers' resistance to standards can be an impediment. For ease of communication, said Kodak's Noxon, it is important that everyone work the same way, with the same standards. Moreover, resistance to standards makes it difficult to create a central database. And Betcher noted how hard it can be to keep every-

Seals of Approval

Anyone who doubts the possible payoff of concurrent engineering should consider the stunning reversal of fortune at Federal-Mogul's oil-seal division

When Ernst & Young wants to show off a successful concurrent-engineering client, it points to Federal-Mogul's oil-seal business. Before concurrent engineering, Federal-Mogul was losing on 80 percent of its oil-seal bids. Now that it can provide sample seals in 20 business days instead of 20 weeks and has improved customer responsiveness, the company, based in Southfield, Mich., wins up to 80 percent of its bids.

Yet Reuben E. Slone, the manager of Ernst & Young's Detroit-based Automotive Industry Services Group, one current. "We still have people who haven't used the things we have had for four or five years now."

The misunderstanding may be mutual, but the problem is the IS organization's. Engineers are in the driver's seat, and the burden is on IS to better understand their counterparts.

For IS, facilitating concurrent engineering means supplying information technology. IS provides communications, data and analytical tools: networks, voice and electronic-mail systems, databases and computer-aided design and manufacturing (CAD/CAM) systems. This isn't much of a problem, say IS executives, provided they can settle on a platform and a set of standards. These technologies are proven, with many well-established products and vendors to choose from. "IS has the easiest, most fun role in the whole process, because I don't see much technology missing to have a rather robust concurrent-engineering effort," said Wojciechowski.

But a piece of the technology puzzle is missing: software for the coordination of the concurrent-engineering effort. Technology has not yet caught up with the baton-passing and bookkeeping aspects of concurrent engineering: managing and facilitating the flow of work, keeping a detailed record of the product team's progress and keeping current drafts and data on the product up-to-the-minute yet accessible to all. These chores require access to a powerful and flexible database by workers in various disciplines and locations, involved in different aspects of the manufacturing process and working on different computer systems.

"That's where things start getting messy," said Slone. "The software industry that supports document management—change control, revision control, who has what document where—is immature. You end up either getting a vendor to write something to meet your specifications or writing your own [software]."

Federal-Mogul and Eastman Kodak, for example, are working closely with software companies that are developing new coordination software. Federal-Mogul has made the "gut-wrenching" decision to work with a

admits that Federal-Mogul's concurrent-engineering effort was an atypical one. The president of its Chassis Products Operations, Fred Musone, personally sponsored and inspired the effort and remained fervently active throughout. Ernst & Young consultants were integrated into the project, which Slone co-directed with a Federal-Mogul manager named Larry V. Smith—whose most atypical characteristic is that he is an IS manager.

Smith, however, was the only candidate with large-scale project-management experience. He was chosen for this reason despite "concerns that [he] didn't have the engineering background and actual manufacturing experience," said Tom English, Federal-Mogul's vice president of information services. Smith's 25 years of experience with the company, his reputation as a "good citizen," and his role as manager of technical services positioned him as a "neutral third party with a whole lot of credibility."

Smith succeeded, said English, because he acted as a coordinator, not a czar. "He didn't try to come on as an engineer or know-it-all. He was used to dealing with technical people and projects. He was skillful at getting engineers to work together and get past the ego problems, and he was very detailed in his coordination efforts." When problems arose, according to English, Smith had the power to hold up the project and bring in the president if he could not resolve them within the team.

LARRY V. SMITH: *"We downplayed the role of technology. We kept stressing the people and process side of it."*

Smith attributes the project's success to its reliance on a holistic implementation approach. "We downplayed the role of technology. We kept stressing the people and process side of it. We weren't creating just an IS or an engineering application, but a business system. If we had gone into it as an IS application, we would not have been successful."

Besides Smith, two other IS staffers played key roles. One was an "extremely bright" young engineer who was pulled into the IS organization and trained in IT. "Because he has an engineering background, he was a great interface with all those folks," said English. The other was a "database guru" who was crucial since databases were key to the effort. "Those two were the nucleus: the technicians that made the whole thing work."

The IS role in the oil-seal business has lessened, however, now that its concurrent-engineering effort has been completed and the systems supporting concurrent engineering have been built. IS's responsibilities now consist of maintaining and enhancing the systems, and Smith is no longer involved.

The new challenge is spreading concurrent-engineering practices to other Federal-Mogul divisions. "The concept is valid," said English. "But I won't kid you: Each division has its own specific needs. What you did for one division doesn't necessarily transfer to others. The IT tools we created for the oil-seal division don't all apply to others." *—A. Alter*

PHOTO BY JACK VAN ANTWERP

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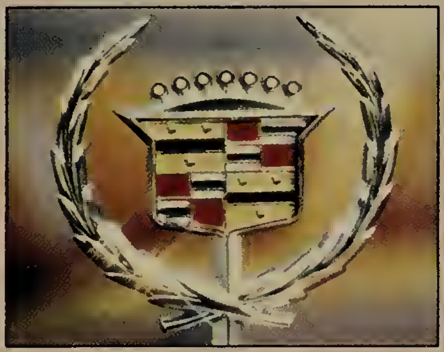
Concurrent Events

Concurrent engineering has altered organizational culture at three different companies and, with it, the fundamental ways in which people work



Cadillac

For Cadillac, concurrent or simultaneous engineering means a new culture and a new way to design and build its extraordinarily complex product—luxury cars. Engineers, designers and assemblers are now members of vehicle, vehicle-systems and product (parts) teams that work in close coordination, rather than belonging to separate, isolated functions as before. Assembly-line workers, dealers, repair-shop managers and customers provide insights to engineers involved in product and process design.

"Simultaneous engineering is about getting profound downstream knowledge to people earlier in the process so they can make the best decision," said Don Nichols, division manager of EDS/Cadillac, in Detroit. "It needs teamwork, trust and empowerment."

To inspire cultural change, Cadillac has created the position of champion of simultaneous engineering (a role that combines keeping the process on track, preaching to the choir and motivating the recalcitrant) and sent 1,400 Cadillac employees to seminars run by W. Edwards Deming, the quality expert who inspired the Japanese. Cadillac has also established an "Assembly-Line Effectiveness Center" where production workers rub shoulders with engineers, critiquing prototypes for manufacturability.

John Deere & Co.

John Deere & Co.'s Industrial Equipment Division in Moline, Ill., has had two concurrent-engineering efforts. The first, begun in 1984, failed because management retained the traditional manufacturing departments. Designers and process engineers who were assigned to task groups remained loyal to the interests of their disciplines rather than to the overall enterprise.

In 1988 the division reorganized. Staff members now report to product teams and answer to team leaders, not functional department heads. "We did get the product focus, which is absolutely essential," said James D. White, the division's vice president of manufacturing.

Early in the engineering process, teams create a "product-definition document" that precisely defines the product, sets deadlines and lays out a manufacturing plan. Products no longer change as each department works on them, White said.

The result has been gradual improvements in manufacturing processes. There are now fewer experimental designs, and it is possible to produce prototypes in the production environment. The advantage of this is that in addition to checking for flaws in the prototypes themselves, engineers can simultaneously perfect the manufacturing process.

Federal-Mogul

The first Federal-Mogul unit to adopt concurrent engineering was its troubled oil-seal business. Now the approach is being introduced in other units of the Southfield, Mich., precision-parts manufacturer.

Success in the oil-seal business—where products are simple but must meet exacting specifications—requires rapid turnaround on bids and prototypes, and strong customer service. Today Federal-Mogul wins orders it once lost, by providing estimates to customers in minutes instead of weeks and producing sample seals in 20 working days instead of 20 weeks. Federal-Mogul accomplished this by adopting a cross-functional product-team approach to manufacturing, encouraging consensus-building and empowerment and building new, enabling IT applications.

FEDERAL MOGUL

Key applications include networks allowing all plants to share CAD drawings and machine tools; a scheduling system that automatically notifies appropriate team members when a new order comes in; an engineering data-management system; and an online database of past orders. *—A. Alter*

WOODY NOXON: *"IT enables people far apart to work concurrently. The people who can enable this to happen should be part of the process."*

PHOTO BY ALAN FARKAS

start-up firm, said English. Kodak is working with McDonnell Douglas. In exchange for acting as test sites, they get a hand in developing the software and first rights to use the product. EDS/Cadillac, the division of EDS which provides IS support for General Motor's Cadillac division, is developing a "common timing system" and a parts-development information system to coordinate the information needed by different functions and teams.

Meanwhile, companies muddle through with the systems they've already built, or what's available in the market. Perhaps, said Slone, IS will be more readily accepted in the planning process when the technology of coordination matures and IS departments better understand engineers' needs and requirements.

Considering these frustrations and limitations, one may wonder how IS executives get out of bed Monday mornings. It helps to recall Wojciechowski's comment about the fun of concurrent engineering. IS has important and interesting work to do.

In addition to requiring the creation of networks, databases and analytical tools, concurrent engineering is inspiring some inventive application-development work. Sundstrand Aviation "has developed an inquiry system to look at common parts, so we could avoid redesigning something we've done before," said Wojciechowski. The system has allowed Sundstrand to cut the number of fasteners it uses from 4,000 to 800. Federal-Mogul has set up what English calls "the virtual tool room"—a system that for the first time allows a Federal-Mogul oil-seal plant to use tools located at other plants. Slone calls this application "common sense coming home to roost."

Cadillac has developed many systems that have improved its manufacturing processes. According to Don Nichols, division manager of EDS/Cadillac in Detroit, EDS is developing "software that is able to recognize the downstream impact" of decisions made early in the manufacturing process. One program is an expert system that helps designers optimize their designs for manufacturability. Another is a "constraint-management expert system," integrated into Cadillac's CAD systems, that warns designers when a design is unmanufacturable. EDS has also established networks that provide feedback from "listening-post" dealers, repair shops and customers directly to the appropriate vehicle- and component-development teams.

Concurrent engineering does not produce instant Baldrige prizes and overnight turnarounds but, rather, slow and steady improvement in manufacturing processes. So it will be with IS participation and partnership, as IS gains credibility and a better understanding of the needs of manufacturing engineers. "Each day," said Betcher, "we get one more user on the wagon, one more project where we've tried the new methods. New engineers coming in tend to be more receptive. We are getting progressively better." CIO

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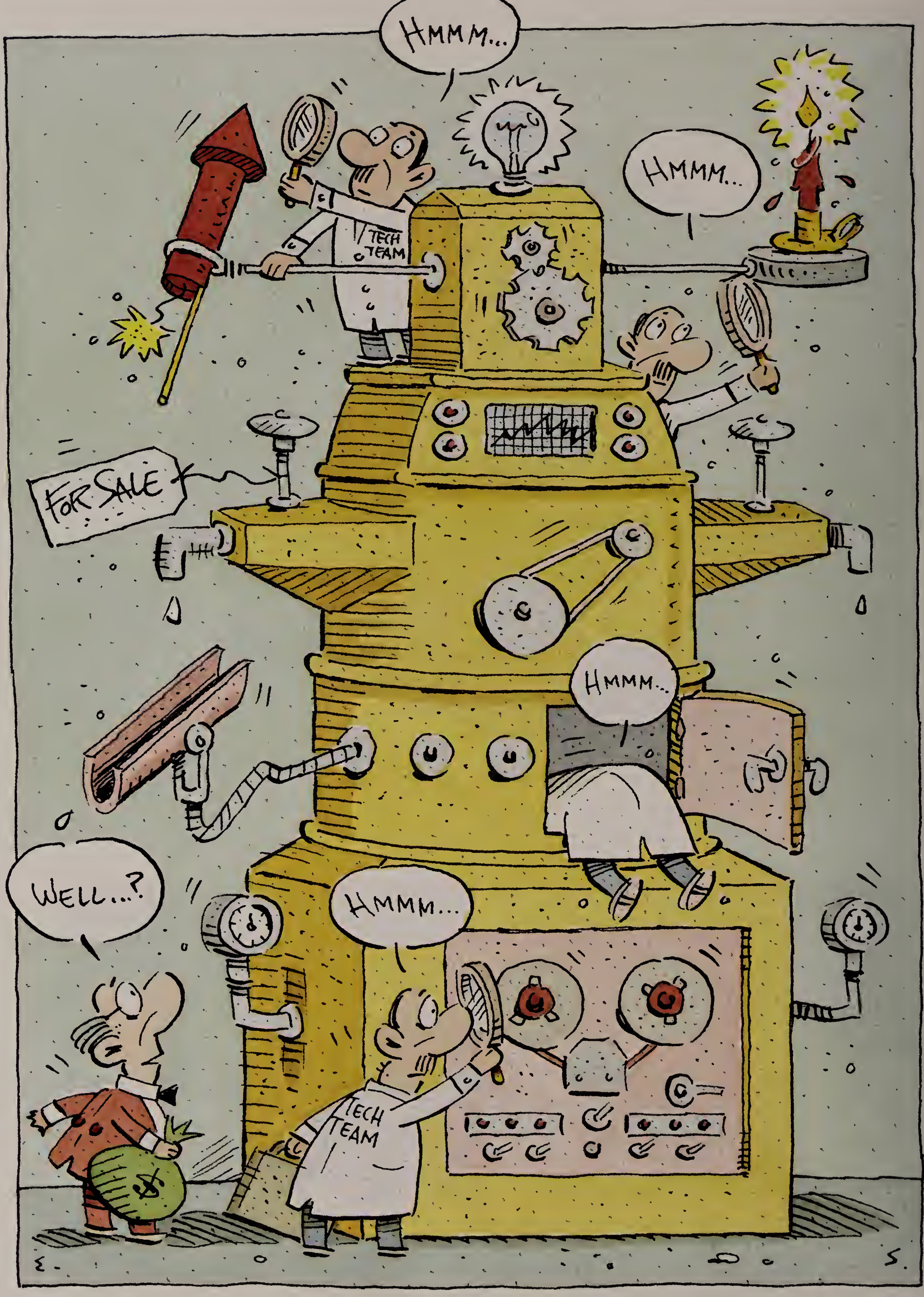
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TECHNOLOGY TALENT SCOUTS

Specialized teams scope out the front lines of technology to guide their organizations' executives in strategic decision-making

BY THOMAS KIELY

ILLUSTRATION BY ELWOOD H. SMITH

THE MODERN ORGANIZATION is awash with committees—ranging from the meeting of the management inner sanctum to the ragtag planning committee for the year-end holiday party. But at a handful of private- and public-sector organizations, teams of technology watchers are proving distinctive in at least one major respect. Individually, few of these teams' members make decisions that will steer the future directions of their employers. Senior technical staff, mid-level general managers and researchers are not the kind of folks who pick up their mail in the executive suite. But in aggregate, these teams are more influential than the sum of their parts. Their work will help to shape their organizations' strategic directions.

Why should senior managers entrust such critical issues to people outside the circles of power? After all, if the holiday-party committee screws up, the outcome is at most unpleasant. But if a technology committee misconstrues a business opportunity, the consequences may be dire.

Team members deserve

> *"The best strategies, and the most accurate strategies, originate on the front lines."*
>
> *–Gerry Butters*

management's trust because, while their positions may not be the most exalted, their perceptions are strategic. "The real notion of what strategy is comes from these people," said Gerry Butters, Northern Telecom's executive vice president of public networks and marketing sales and service. The pace of change and the ever-evolving, complicated mix of available technologies compels organizations to rely more heavily upon the knowledge and expertise of employees that have traditionally been far from the top of the corporate pyramid. "They are frontline people," Butters said. "The best strategies, and the most accurate strategies, originate on the front lines."

Northern Telecom is using one such frontline group to look at desktop multimedia. The technology could offer business opportunities for the company, but just as importantly, it could be a boon to the company's research efforts.

In the past, if Northern Telecom wanted to chase a short-term opportunity, it might gather the necessary employees together in one location and fund a feverish three- or four-month push. But dragging people halfway across the country was expensive and disrupted employees' lives. Now Northern Telecom thinks it has a better idea.

The company formed a 12-member multimedia committee composed of technical people at sites in Montreal and Ottawa and at company headquarters in Nashville, Tenn. The team also includes employees of a California-based company (which Northern Telecom does not want to identify) who have been inventive in digitizing video. Team members communicate with each other via teleconferences and through what Butters calls "print desktop teleconferencing": telephone voice communications supported with text files retrieved from the company's network and shared by team members on their respective desktop machines. The team also gathers for face-to-face meetings each time there is a

Defensive Measures

• •

The Defense Department's new CIO wages a war of efficiency against unproductive committee work

Elsewhere in the Pentagon, newly appointed Defense Department CIO Paul Strassmann has formed a committee of top brass from each of the services and agencies to begin hammering out issues of standards and budget allocations. Strassmann, a former vice president of Xerox Corp. and author of the controversial book *The Business Value of Computers,* was brought into the department last spring to provide guidance to Deputy Secretary Donald J. Atwood Jr. and Defense Secretary Richard Cheney (Strassmann's actual title is Pentagonish: director of defense information, and his rank is principal deputy for command, control, communications, intelligence and computers.) Presumably he will also put to the test the ideas he has long espoused about evaluating technology and management—it would be "hypocritical," he said, to espouse one set of ideas and practice another.

Strassmann is no fan of committees, as necessary as they may be. Calling committee work "one of the most wasteful and prevalent [management] activities in the U.S.," he estimated that "between [30] and 40 percent of all management time in America is spent on committee work. The lack of effective committee work is a detriment to productivity."

In an effort to ensure that his committee is more productive than the average, Strassmann has imposed a rigorous structure. Meeting every Wednesday from 10 in the morning until noon, the committee works its way through a set and immutable agenda. (No wild cards are admitted to the agenda, and committee members must make a written case to place items on future agendas.)

Research on the items to be discussed is completed by each member's staff prior to the meeting; position papers are advanced; some haggling occurs. Decisions at the meeting are made by majority vote, and Strassmann said that the implementation of those decisions is set into motion quickly afterward.

The rigid structure is also an attempt to keep wasteful turf battles from gobbling up meeting time. Competition among the defense services has long been intensely politibreakthrough in its project.

That's better than moving people for the duration of a project, but the multimedia committee was formed to see if the company could go one step further. "One of our game plans here is the concept of the 24-hour, seven-day-a-week virtual laboratory," said Butters. Northern Telecom has research units scattered across the United States, Canada and Europe, and soon in the Far East. Voice, data and conferencing technologies already allow dispersed employees to transcend geographical barriers—as the desktop multimedia committee proves. But communication among them is still clumsy compared to the kind of work that is done by researchers housed at a single site. Perhaps a single site could be created electronically, Butters suggested.

If their virtual laboratory gets off the ground, it could help to quicken the pace of research and shorten product cycles. Northern Telecom also foresees potential products emerging from the concept.

Butters says the team concept looks promising so far, and he expects Northern Telecom will work more with it in the future. (Another team, composed of multidisciplinary specialists from England, Canada and Texas, is currently studying what Butters calls personal communications—how might customers, each possessing a single personal-communications number similar to a phone number, travel anywhere in the world and make or receive calls and messages as easily as they now do in the home or office.) But he has already sold himself on the strategic value of technology teams. "The hierarchical organization will die a quick death," he said. "Ideas come from interacting with the people on the front lines."

The workstation group's conclusions influenced purchasing and utilization decisions inside Westinghouse and colored management's business decisions about the way workstations would cut across certain business lines.

Westinghouse Electric Corp. of Pittsburgh has used committees to study workstation trends, chart the company's computing architecture and study the impact of distributed computing on employees and workflow. The workstation committee, formed about five years ago and composed of IS staff, predicted that the market for workstations was limited—both inside Westinghouse and in the greater market—by the rate at which employees could apply the technology to their work. In tandem with the work of other committees, the workstation group's conclusions influenced purchasing and utilization decisions inside Westinghouse and colored management's business decisions about the way workstations would cut across certain business lines.

More recently, another IS committee assembled a visionary statement of the future computing and communications architecture for the company. The committee's report was published internally last year, and pieces of the plan are in the early stages of implementation. Aside from proposing a shape for the company's computing architecture, the committee also focused on such issues as security, administration and human resources, and it recommended an emphasis on groupware.

A third committee is currently

cal, and that situation is worsening now that the military has begun to downsize. The members of Strassmann's committee aren't shrinking violets when it comes to Pentagon feuds—by and large they hail from the ranks of three-star generals (and the equivalent in other services)—so meetings could potentially get out of hand. "There are disagreements among the members," Strassmann conceded. "The disagreements are political, but they may [be voiced] as technical issues."

The solution has been to divide large issues into ever smaller ones, Strassmann said. "Then we deal with implementation issues rather than political ones. The purpose of effective group work is to [address enterprisewide] issues, but we deal with it in specifics. If there is a problem, we cut it down even further."

—*T. Kiely*

> *"Getting people together and sitting down out of the normal workplace environment and discussing what we really think is going to happen—free from the politics, free from the vendor pressure—I've found that a very valuable thing to do."*
>
> *–David Edison*

studying the impact of interconnected LANs upon the organization. While it is composed primarily of technical staff, a few Westinghouse non-technical general managers also sit on this committee. The managers have been pushing the committee to consider the "human issues" of any LAN plan, noted David Edison, executive vice president of the Communications Systems Division. "This is an important internal Westinghouse issue," Edison said. "LANs will become tools for the corporate population at large, so the people issues are absolutely paramount. How these systems fit into your institution is the big issue."

Edison is upbeat about the work of teams at Westinghouse. "Getting people together and sitting down out of the normal workplace environment and [discussing] what we really think is going to happen—free from the politics, free from the vendor pressure—I've found that a very valuable thing to do," he said. "We're a diversified company. So you have many narrow special interests. But we also have many things in common, such as telecommunications. Technology committees are a very effective way to make these things happen."

Using teams to do the groundwork for strategic decision-making isn't the monopoly of the private sector. For the last three years, a working group of Pentagon technology specialists—known as the Working Group on Critical Technologies—has scanned the gamut of technology trends, from processors to biotechnology, in order to identify those that could prove critical for the nation's military. Although the secretary of defense and top managers in each of the military services comment upon, sometimes amend, and must eventually approve the working group's final report (which is presented to Congress once every two years), essentially this group devises an enterprisewide technology vision for the nation's military.

The director of Defense Research and Engineering (who reports to the undersecretary of Defense Acquisition) oversees the group, although responsibility for development and acquisition of technology rests with the services and with units such as the Defense Advanced Research Projects Agency (DARPA). First formed three years ago, the group is composed of senior-level technology specialists from each of the armed services, as well as from DARPA, the Defense Nuclear Agency and the Strategic Defense Organization. A Department of Energy representative also sits on the committee. While this might seem like overkill, "no one individual could have all the knowledge and all the points of view needed to come up with this list," pointed out Raymond Siewert, acting deputy director of Defense Research and Engineering (Research and Advanced Technology).

"Our charge is to look at what [technologies] are most critical for the long-term superiority of U.S. weapons systems," said Group Chairman Leo Young, staff specialist for advanced concepts, who reports to Siewert. Coming up with a list wasn't easy. Pentagon turf-mindedness initially got in the way. Young recalls that he brought a list of 40 technologies to the first meeting, hoping the committee would whittle this down to 20. But three hours after the meeting began, the list had mushroomed to over 100 items. Everyone had their pet technologies.

"At the first meeting, everyone has to make their God-and-country speeches," Siewert said. But eventually group members began to see that they could only make progress if they focused their attention on technologies that cut across functions. So while the Navy wanted to explore anti-submarine warfare "technology," the working group redefined that as a system, composed of several technologies of broader interest.

Once the ground rules were agreed upon, the group set about looking for technologies that were bedrock and pervasive. In the end they settled on 22 key technologies.

Siewert enthusiastically calls the committee a success. "We've got a pretty good process in place," he said. "What we're lacking is a tie-in

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"We're finding that to build product X, you need technologies A, B,C, D, E and F. In order to get those technologies, we have to do research in quite a number of areas."

–Edward J. Krall

to the [Pentagon's] overall technology strategy. If you're just trying to manage by critical technologies, that isn't enough. What about non-critical technologies," such as those needed in civil engineering or medical research?

At NCR, in Dayton, Ohio, a group of scouts seeks out new technology opportunities for the company's diverse business units. Technology is the business of the computer maker (recently acquired by AT&T), so keeping up with technology is strategic in the fullest sense of the word. To that end, NCR is in the midst of reorganizing its Corporate Research & Development Division, which it has renamed the Technology and Development (T&D) Division. Within the new division, the technology investment group, composed of about 20 people, searches for technologies that NCR can use internally or turn into products. The technologies they look for are promising but unfinished, generally three to five years from completion.

Seven of the group's members are assigned to the Microelectronics and Computer Technology Corp. (MCC), a consortium of IT vendors based in Austin, Texas, in which NCR is a shareholder. (See "Team Technology," *CIO*, September 1.) The balance of the group is headquartered in Dayton. "It's the responsibility of the individuals [in technology investment] to find technology and present a good business case for it," explained Edward J. Krall, NCR's shareholder representative to MCC and a member of the technology investment group. The case is made either to senior NCR executives in Dayton or, more likely, to managers of one of NCR's decentralized business units.

Team members are senior technical staff who tend to specialize in particular technologies, including liquid-crystal displays, artificial intelligence and object-oriented programming. They attend conferences, visit research programs at universities, keep up with technology development in small start-up companies or even larger companies, and follow leads to find new and useful technologies. If they see research they like, they fund it.

For example, the group funded a faculty member at the University of Texas who was working on a benchmark for transaction processing. It was a two-year effort, recently completed, and his studies influenced work done in transaction processing at NCR.

"We're finding that to build product X, you need technologies A,B,C,D,E and F," explained Krall. "In order to get those technologies, we have to do research in quite a number of areas." That means fanning out across the world of research, looking for the useful, and it may include promoting technology alliances.

NCR is a very decentralized company (although its merger with AT&T could change its organizational structure). In a sense, the technology investment group provides a line of communication among researchers in different units and throughout the world.

The group also tries to involve the individual business units in the funding effort. (Plant managers have plenty of freedom and can call their own shots.) "We have asked our business units to fund at least part of the technology they might need, as opposed to having a sugar daddy in Dayton take the money by allocation," said Krall. "If the general manager is spending $100,000 [to fund] a university for some technology, he will manage that. Even if T&D provides half the funding, or some portion of it, we want to get it on the budget of the local business unit as quickly as we can, because now it'll be managed.

"Back in the good old days, our R&D budget was much bigger and was funded as an allocation among all the plants," Krall explained. "Now we're trying to cut down the allocation, cut down the budget, and therefore we're getting more selective on the technologies that we fund. And I find that this is more and more the case among MCC shareholders. It's the evolution of American industry."

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Teamwork Tools

Groupware supports the theory that two (or more) heads are better than one

BY KATHLEEN MELYMUKA

The islands of information created by personal computing have become barrier reefs to the flow of knowledge. Ownership of information, implicit in the PC, is at odds with the need for sharing in the team approach that is on the rise in so many corporations today. Computing has to change from personal to interpersonal, and groupware is designed to make that happen.

While networks provide the infrastructure to move information throughout an organization, groupware is the traffic cop that directs that flow. Just as standard operating systems orchestrate lower-level operations, groupware has the potential to integrate operations across an enterprise, facilitating the team approach.

Different kinds of groupware enable different types of workgroup arrangements. At its most basic, groupware allows teams working at the same time in the same location to access and share information; at its most sophisticated, it enables workgroups to transcend the limits of time and space while facilitating the development and deployment of materials. User numbers, while not yet vast, are on an impressive trajectory. According to International Data Corp. in Framingham, Mass., the number of groupware users will rise from 2.8 million in 1990 to 7.5 million in 1992.

In any event, groupware can involve greater numbers of people in problem-solving efforts. Higgins, released in 1986 by the Higgins Group at Enable Software of Alameda, Calif., was an early stab at groupware. Higgins provided services such as E-mail, group scheduling and calendar management in an attempt to facilitate team efforts. From this beginning, groupware has branched off in a number of evolutionary directions.

All the major groupware offerings are based on client/server technology, but offerings from hardware makers tend to require at least some proprietary hardware, while packages from software makers run on standard equipment.

ILLUSTRATION BY WILLIAM RIESER

Though approaches to groupware vary, most vendors agree that effective team-oriented software includes an essential core of features. It should allow users to interact within and on behalf of a group by facilitating access to and organization and distribution of information. It should enable users to create, maintain and access permanent and semi-permanent records while allowing them to reorganize information to fit a current project. Since a workgroup is by nature cross-functional and temporary, the software must respond flexibly to changes in the group's needs and membership. Finally, it should enable group members to communicate effectively without face-to-face meetings and to work outside the constraints of time and

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Groupware uses these characteristics to support applications such as product development, sales management, customer tracking, status reporting, project management, crisis management, strategic planning, information distribution and enterprisewide communication.

Groupware systems, designed for non-technical users, are loaded with friendly devices such as intuitive, graphical interfaces and user-transparent operations. For example, documents can be located by characteristics or combinations of characteristics such as title, author, dates and key words; and procedures for accessing or printing documents are the same whether a document is stored locally or anywhere around the world.

Groupware users can combine text, data, graphics and images from multiple sources into a single document, to which all members of the group can add annotated comments. Some systems have imaging capabilities, and some can include hypertext "hot links" to related information.

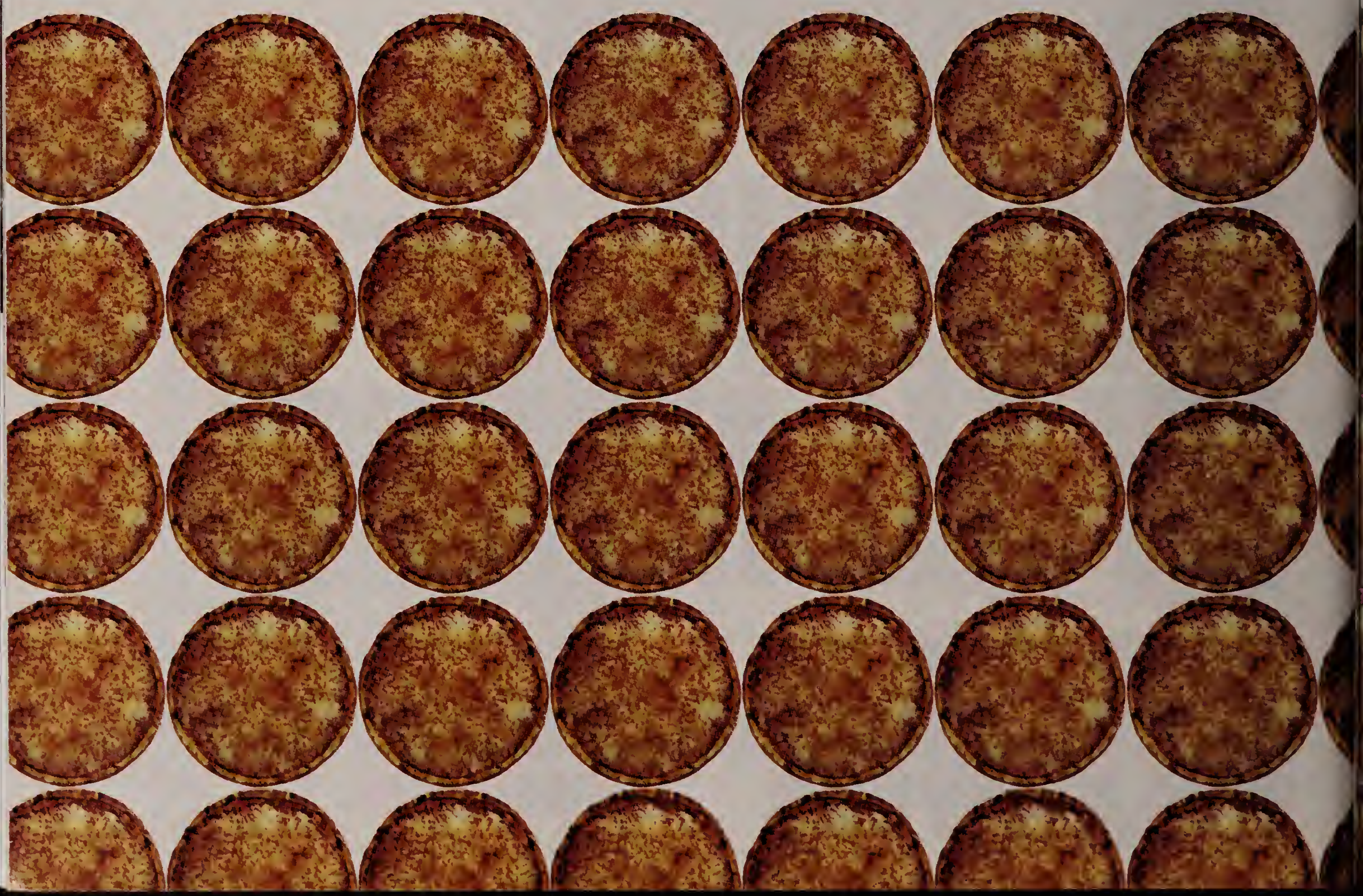
Some groupware can be programmed to take care of routine tasks automatically. Xerox 's GlobalView allows users to create special routines or "agents" that perform tasks on their own. An "agent" could access weekly sales figures from the corporate mainframe, download them into a predefined sales report format and have them printed at sales offices around the country or the world.

AT&T's Rhapsody can be programmed to gather information from files, ask other users for data, send task assignments to other users and track their progress, schedule meetings, arrange teleconferences, put reminders on calendars, distribute reports, flag potential problems and track the status of projects.

When users of NCR's Cooperation perform the steps of a task, the system creates an electronic trail that allows the task to be documented and automated, ensuring consistent execution in the future. Cooperation can also track and report on the status of critical success factors such as sales results and inventory levels.

> *"Groupware is an enabling technology, but you've got to have something to enable. You don't just stick people on a LAN and—poof!—you're a team."*
>
> *–Susanna Opper*

While such features are dazzling, experts caution that attempting to implement groupware without the appropriate organizational and cultural underpinnings will guarantee disaster. "Groupware is an enabling technology, but you've got



to have something to enable," said Susanna Opper, a groupware consultant in Great Barrington, Mass., who has written extensively on the topic. "You don't just stick people on a LAN and—poof!—you're a team. If you try to put the new technology on top of an old organizational structure, you won't get change; you'll get a mess."

If your organization isn't functioning in team mode, you need to grapple with the issues of teamwork, and the issues aren't simple. "Workgroup technology goes to issues of privacy, access and control," Opper explained. "It's very hard to build a collaborative environment if people think their success depends on keeping secrets from each other. Part of what I recommend is that you bite off a little bit and chew on it."

Even if yours is a team-driven business, you might want to take a focused approach to groupware, said Robert Johansen, director of the New Technologies Group at the Institute for the Future, a Menlo Park, Calif., think tank. "Look at the pains of the teams and ask, 'How can I add information technology to relieve those pains?' " he said. "I would not just introduce groupware for itself. Especially in these tough economic times, I'd be pain-driven."

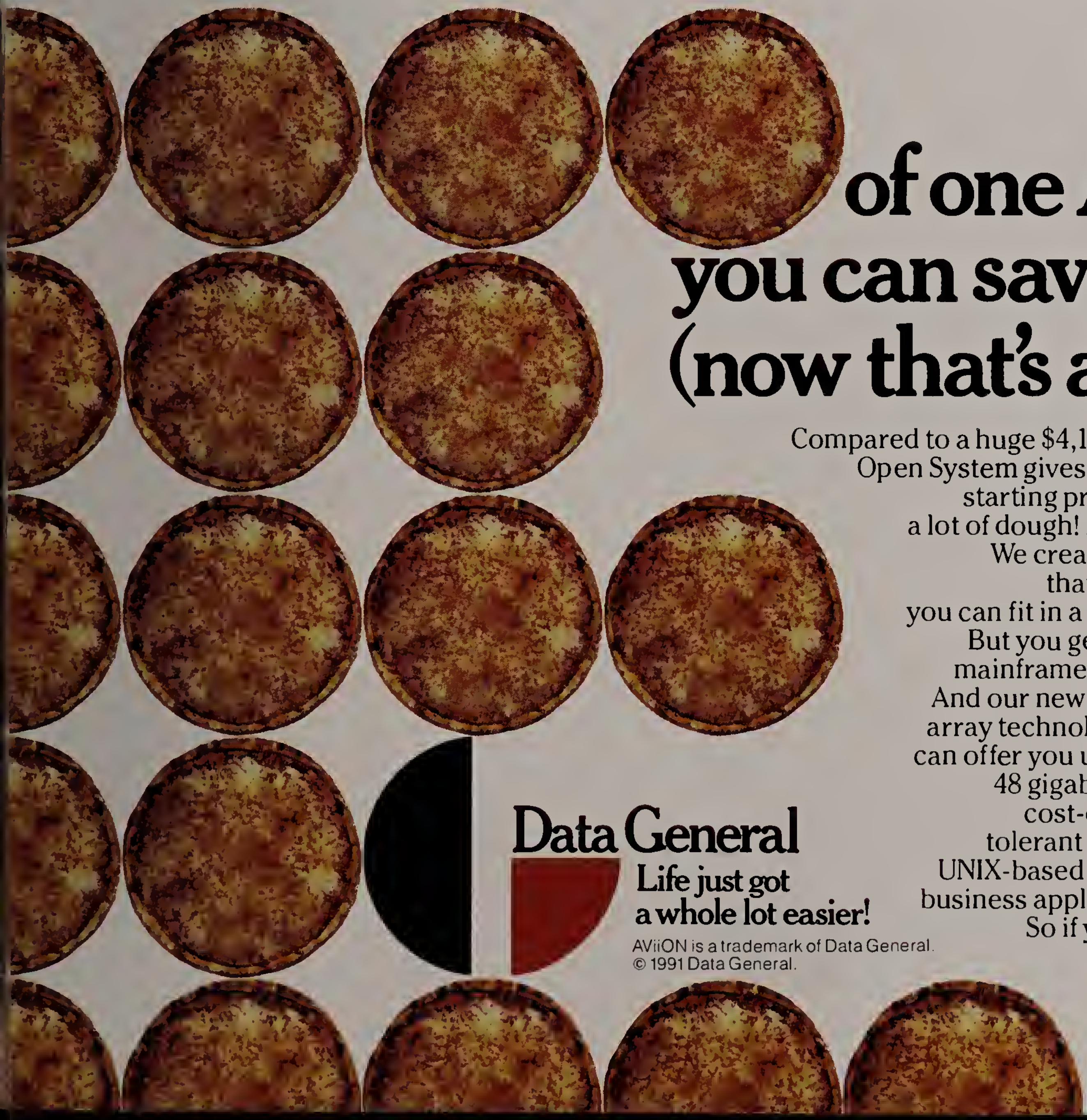
Probably the biggest pain for any team is the built-in inefficiency of its basic forum: the meeting. A couple of new packages focus on this area, providing a pragmatic way to chew on that first bite of groupware.

GroupSystems from Ventana Corp. of Tucson, Ariz., is a room-based, same time/same place system. It attempts to do for meetings what word processing does for correspondence: increase productivity electronically. In effect, it lets everyone in a meeting talk at once. GroupSystems uses some of the characteristics of a slide show, including a moderator and a public display, but it allows simultaneous, anonymous input from all participants. It provides a range of tools to structure meetings productively, elicit and organize input and keep records.

VisionQuest, from Collaborative Technologies Corp. of Austin, Texas, moves the meeting-facilitator format to any condition of time and place. It helps teams to prepare agendas; access presentations, databases or other applications; generate, compare and weigh ideas; prioritize alternatives; allocate resources, and document proceedings of face-to-face or geographically dispersed meetings among members of any group on the network.

Groupware technology is new, and anyone attempting to deal with it, from vendors to users, should realize that mistakes will be made before systems run smoothly. But the need for groupware in team-driven organizations and the potential benefits to be gained make it a force that will not be denied. As the Institute for the Future's Johansen put it, "It has to happen." CIO

Kathleen Melymuka is a freelance writer based in Duxbury, Mass.



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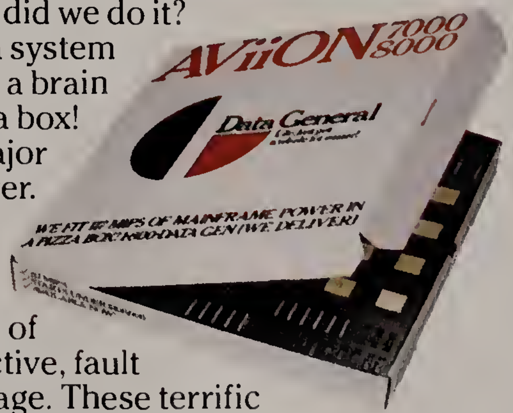
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Picking Up the Pace

The proven success of rapid-development teams suggests that doing a job fast and doing it well don't have to be mutually exclusive

BY DR. RONALD E. LeBLEU and ROGER T. SOBKOWIAK

End users impatient for their critical applications are unlikely to be mollified by the fable of the tortoise and the hare. Fortunately, a new approach to software development allows IS departments to provide tortoise reliability at rabbit speeds.

Rapid development is the use of a highly skilled software-development team to create client-driven software in an accelerated fashion without the loss of quality or system integrity. The computer press has reported that in some cases, rapid-development teams have cut the normal development time by 50 percent or more. Now IS organizations are beginning to take advantage of the new approach, while still carefully watching their colleagues in other companies to see if it is here to stay or merely a fad. IBM believes so strongly in rapid development that it offers to train any company's software-development teams in the process—for a fee—through its "Enterprise Alliance" program.

ILLUSTRATION BY RANDY LYHUS

Hype or harbinger, gimmick or the real McCoy, the important questions to ask about rapid development are: How does it work, and does it have staying power? As more and more companies experiment with this new approach, IS organizations are positioning themselves to embrace the process if it will help them satisfy ever-increasing user demands.

Recently, the IS department of The Travelers Corp., an insurance company in Hartford, Conn., asked the authors to observe and interview two of its very successful rapid-development teams. While specifics regarding the software under development cannot be divulged because of its proprietary nature, much can be shared about the organization and team dynamics that made the Travelers rapid-development process work so well—factors important to any organization that is contemplating such an effort. It turns out that the secret to success has little to do with the technology and much to do with the managers and the client.

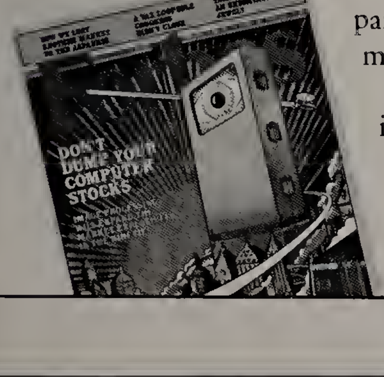
The first thing we noticed was that the rapid-development teams at Travelers were interdisciplinary. Interestingly, the team members were also a mixed group in terms of experience and expectations. Some were relatively new to the company and came to the assignment with the unvarnished belief that the team approach is the preferred approach to complex projects, and that team members do whatever it takes to finish the customer's job. Others were seasoned veterans with a proclivity for approaching all their projects in fresh new ways. Individuals exhibited

Without a computer, finding the two that match could be murder.

Just ask the detectives who spent three years looking for the killer of a New Jersey prosecutor. All they had to go on was a fingerprint left at the crime scene. But with a million prints in police files, how could they make a match?

Only with the help of a computer. One that did what computers of a few years ago couldn't do: Compare millions of images for similarity. The computer nailed the murderer.

Police work isn't the only line of work that can benefit from the harnessing of computers to images. As Forbes pointed out in its November 26th cover story, oceanographers used this computer imaging technology to turn a warehouseful of data into a couple of file cabinets. One law firm used it to scan 325,000 pages of documents—a search that would have kept 100 paralegals busy day and night for four months.



The applications for computer imaging systems are so dazzling that one day nearly every office worker could be connected to or near one. What all this means to a sluggish computer industry is growth. The kind of growth that will propel it into the year 2000, and beyond. The Forbes article contradicts Wall Street's conclusion that computers are just another cyclical capital goods industry.

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a strong, though not exceptional, programming talent. Some had worked for the same clients before, while others had no prior knowledge of the clients or their missions.

In addition, both teams were working with clients that had already attempted to solve these same problems—one by using an outside vendor, the other by trying to make use of another in-house system. Both efforts had proved disastrous, setting back the introduction of new products and services by several months. Because of these painful experiences, the clients came to the rapid-development process with an exceptionally clear understanding of what they wanted from their systems. They were able to make specifications as fast as the programmers could write. The earlier failures had also created within the clients a passion for results and a willingness to work intimately with the development teams on system design and implementation.

The clients shared an additional characteristic that contributed to their projects' success: a talent for abstract thinking. They knew computers well enough to understand what was and wasn't possible. They could even visualize screens before they were constructed.

The nature of management, particularly of the sponsoring manager, proved to be at least as important as the nature of the clients. Those in charge of the Travelers projects had to tolerate and even support overtly countercultural behavior. Rapid development can be anathema to the traditional company, and particularly to IS. From our observation of the Travelers groups, we found that a team is more willing to break the rules, make tough demands and blow the whistle on anybody who impedes its progress. In such a situation the sponsoring managers had to practice incredible organizational diplomacy to resolve conflicts, soothe bruised egos and negotiate, negotiate, negotiate.

The managers of the two teams were also responsible for overseeing the boundary between the team and the rest of the organization, simultaneously preserving decision-making processes within the established chain of command and protecting the integrity and freedom of team operations. No small challenge! This type of management is not for the faint of heart or the thin-skinned. Applause for a job well done comes—if ever—months after the project is complete.

The teams were shameless in borrowing code, forms, processes and whatever else they deemed necessary.

The rapid-development process can be divided into six parts. The Travelers efforts started with the two teams going away for five days of training on a common toolset. It was a time for the members to get to know one another, although this wasn't their stated objective. Upon returning to the company, they dove into joint application design sessions, during which the teams and their clients interchanged roles as facilitators, inquisitors and data generators. In three days they hammered out the specs and the data requirements for the systems.

Next came the modeling and the what-can-we-borrow-from-other-systems phase. In this case, the "Not Invented Here" factor had no opportunity to prevail. The teams were shameless in borrowing code, forms, processes and whatever else they deemed necessary.

When all preliminary information was assembled, the teams conducted a peer review before other members of the IS department. (Travelers employs a number of internal review committees that pass judgment on all software-development efforts.) Their message at this stage was unmistakable: "This is the direction in which we are going; if you don't speak up now, help or get out of our way." The teams reckoned that this kind of open and forthright presentation was likely to win the much-desired endorsement and support of these influential forces.

During the actual software development, team members were sequestered at off-site locations. For four weeks they coded and recoded. At least once a week, the clients appeared to review the work and encourage their progress. This development period culminated with the clients' demos of the systems. At that precise moment, the clients, because of their close involvement throughout the development process, knew all that was necessary and had the confidence to operate the systems. An incredible feat for such a short period of time.

The final phase of rapid development deals with packaging, documentation and all the other details required to make a system operational. In the case of Travelers, the intense, carefully orchestrated effort that preceded this stage facilitated these final processes.

From start to finish, the two projects averaged three months each. By comparison, one of the clients had been driven to embrace rapid development after the failure of a system that had taken a year and a half to develop. Both clients are extremely pleased with the results; so much so, in fact, that they are in line for other development projects. The team members, who are now back at their regular jobs, said that working on the rapid-development project had been one of the most fulfilling experiences of their professional lives. And the sponsoring managers are busy planning and launching new rapid-development efforts with other clients.

Travelers owes the success of its projects to motivated teams, astute sponsoring managers, experienced and savvy clients and the importance of their results to the success of the business endeavor. IS organizations that lack any one of these critical factors will likely have an inordinately difficult time launching and nurturing rapid-development initiatives. CIO

Ronald LeBleu and Roger Sobkowiak are managing partners of Software People Concepts Inc. in New Haven, Conn., a consulting firm specializing in managing change in an IS organization.

MAT/COBOL defines the meaning of static analyzer!

sta•tic an•a•lyz•er (stat'ik an'e-liz-r) *n.* **1.** A computer program that analyzes and diagnoses other computer programs producing diagnostics and documentation significantly beyond that available with compilers. 2. **MAT/COBOL** (see). **3.** A program that analyzes many dialects of a particular programming language. **4.** A computer program that extracts critical information from other computer programs without changing them in any way. **5.** A computer program that diagnoses program elements used without a value, circular calling within a system, hidden perform traps, and more, and provides name, file, and Copy file cross-reference tables for entire systems.

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—Telecommunications Manager

New York Telephone speaks my language.

With the whole company going digital, our 10-year-old PBX was embarrassingly analog.

Huge footprint. Fixed architecture. Its user features were archaic, its management features non-existent. Adds, moves, and changes were a full-time pain. So was maintenance.

Still, a new PBX would be a major capital expenditure in an uncertain economy. Out of the question.

New York Telephone had the solution. A feature-rich digital Centrex system with a software-based management module. It’s called NYNEX Intellipath II® Service.

We don’t have to buy it—we just subscribe to it. Since the switching equipment is on New York Telephone’s premises, there’s no footprint at all, and maintenance is—in effect—outsourced. Its architecture is open-ended for easy upgrading and ISDN-compatibility.

Thanks to New York Telephone, our transition to a digital office is now complete.

“Our phone system belongs in a museum.”

–CEO

New York Telephone speaks my language.

For a company that takes pride in its technological sophistication, our phone system was prehistoric.

It took up a lot of expensive floor space. Its features were inadequate. We outgrew it years ago. And maintenance was a constant drain.

Then again, we weren’t about to plunk down serious capital for a new phone system. Not in this economy.

Enter New York Telephone. They had a solution that made sense—a digital Centrex system.

It uses their equipment on their premises, which has a number of advantages. First, there’s no capital investment, just a monthly fee. Second, it takes up no floor space. Third, maintenance is their headache, not ours. Fourth, we can’t outgrow it—we just add lines as we need them. And finally, it has every feature we were looking for—as new features become available, we can add them on quickly and easily.

Thanks to New York Telephone, [illegible]

[illegible]

We’re all connected.

New York Telephone

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FYI

When All Else Fails

ISDN has suffered from the cart-before-the-horse syndrome: The technology existed before there were any applications to take advantage of it. With the announcement of a new relationship aimed at providing ISDN-based applications, two vendors hope to make ISDN a reality.

UDS Motorola will supply ISDN terminal adapters and other data communications equipment to Secure Data Network (SDN), a provider of automatic backup and vaulting services. SDN will incorporate the new equipment into its existing services to create an extensive ISDN-based electronic disaster-recovery network.

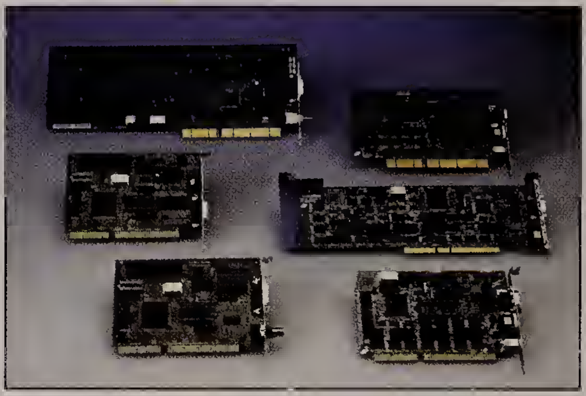
According to SDN, ISDN is ideal for disaster-recovery applications because it provides more bandwidth than current dial-up technologies and allows more routing flexibility in the event of a network failure. Initially, SDN will offer basic rate service, which provides single or multiple 64Kbps digital channels and multiple B channels, which can provide as much bandwidth as needed for a particular application.

Pricing for SDN's service depends on data volume and backup configuration. Additional information is available by calling SDN at 714 727-3000.

Taming the Beast

In cases where a large, sprawling corporate network has become an uncontrollable monster, network managers might do well to look to a new set of tools from Intel Corp. that is designed to keep networks up, running and under close observation.

The NetSight line of management tools includes NetSight Sentry, a full-featured network monitor; the NetSight Analyst, a low-cost, portable protocol analyzer; the NetSight Professional, a combination network monitor and protocol analyzer offering real-time data collection and diagnosis; and a utility called LANSight Support, a Windows-compatible upgrade of an existing Intel network-management tool. The NetSight tools will allow network administrators to isolate and solve problems quickly, reducing the cost of disabled networks and lost productivity.



The Sentry is priced at $1,995 for the Ethernet version and $2,995 for the token-ring version. Analyst is priced at $995, and Professional goes for $7,995 (Ethernet) and $8,995 (token ring). The LANSight Support utility is priced at $395; current users can upgrade for $195. Intel can be reached at 602 869-4428 or 801 379-2200.

Both Sides Now

Corporations suffering strained relations between their IBM hosts and Apple Computer Macintoshes may find relief in Both. That is, Both, the irresistibly punnable product from Connectivite Corp. that creates Mac front-end applications for accessing IBM host-based data.

The advantage of Both is its ease of use. Mac users without programming skills can create front-end applications similar to their other Mac programs. Furthermore, there is no need to modify the host-based application, according to Connectivite, which is based in Tarrytown, N.Y.

Early user Allen-Bradley Co., an industrial systems and control manufacturer in Milwaukee, reported that application building with Both was 25 percent speedier than with other products. Accessing IBM mainframe data was significantly simpler with the new front-end's point-and-click graphical interface compared with a previous terminal-emulation package, the company said.

For more information, call Connectivite at 914 631-5365.

When Speed Is of the Essence

For the work-at-home, scientific-engineering crowd, Dolch Computer Systems of Milpitas, Calif., offers the world's first luggable computer based on Intel's superfast 50 MHz '486 processor. The P.A.C. (Portable Add-In Computer) 486-50E uses the 32-bit EISA architecture, a high-speed SCSI interface, and a cache controller to provide fast performance. It offers performance enhancements of up to 50 percent over Dolch's 33 MHz processor machine.

The computer's three full-size ISA/EISA internal-expansion slots with bus-mastering capability offer flexibility and can be augmented with a three-slot Back-PAC expansion chassis. Hard drives are available from 40MB to 420MB with RAM expansion up to 32MB. The portable is aimed at design engineers working with CAD/CAM/CAE applications, software developers who compile huge amounts of data, and scientists or researchers who require quick analyses. It also might come in handy for a *really big* spreadsheet.

The base price is $16,995. Dolch can be reached at 408 957-6575.

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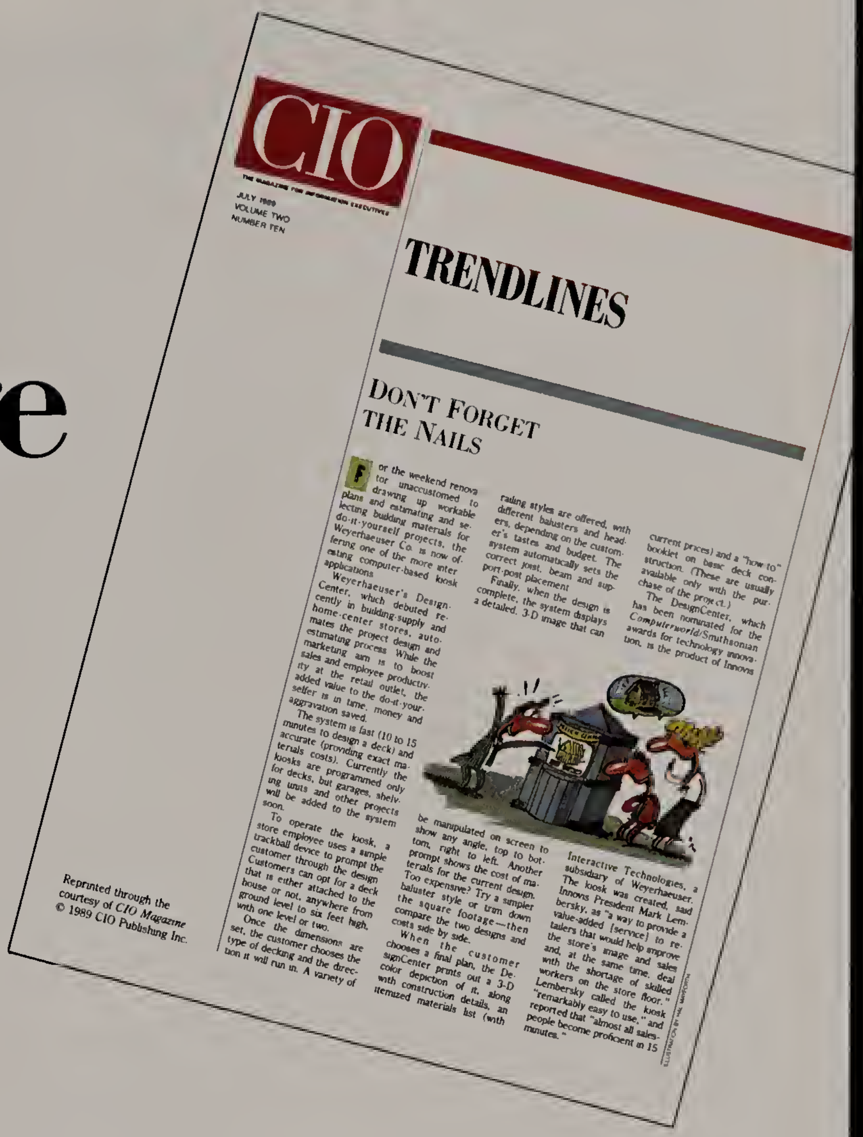

CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

JULY 1989
VOLUME TWO
NUMBER TEN

TRENDLINES

DON'T FORGET THE NAILS

For the weekend renovator unaccustomed to drawing up workable plans and estimating and selecting building materials for do-it-yourself projects, the Weyerhaeuser Co. is now offering one of the more interesting computer-based kiosk applications.

Weyerhaeuser's DesignCenter, which debuted recently in building-supply and home-center stores, automates the project design and estimating process. While the marketing aim is to boost sales and employee productivity at the retail outlet, the added value to the do-it-yourselfer is in time, money and aggravation saved.

The system is fast (10 to 15 minutes to design a deck) and accurate (providing exact materials costs). Currently the kiosks are programmed only for decks, but garages, shelving units and other projects will be added to the system soon.

To operate the kiosk, a store employee uses a simple trackball device to prompt the customer through the design. Customers can opt for a deck that is either attached to the house or not, anywhere from ground level to six feet high, with one level or two.

Once the dimensions are set, the customer chooses the type of decking and the direction it will run in. A variety of railing styles are offered, with different balusters and headers, depending on the customer's tastes and budget. The system automatically sets the correct joist, beam and support-post placement.

Finally, when the design is complete, the system displays a detailed, 3-D image that can be manipulated on screen to show any angle, top to bottom, right to left. Another prompt shows the cost of materials for the current design. Too expensive? Try a simpler baluster style or trim down the square footage—then compare the two designs and costs side by side.

When the customer chooses a final plan, the DesignCenter prints out a 3-D color depiction of it, along with construction details, an itemized materials list (with current prices) and a "how to" booklet on basic deck construction. (These are usually available only with the purchase of the project.)

The DesignCenter, which has been nominated for the *Computerworld*/Smithsonian awards for technology innovation, is the product of Innovis Interactive Technologies, a subsidiary of Weyerhaeuser. The kiosk was created, said Innovis President Mark Lembersky, as "a way to provide a value-added [service] to retailers that would help improve the store's image and sales and, at the same time, deal with the shortage of skilled workers on the store floor." Lembersky called the kiosk "remarkably easy to use," and reported that "almost all salespeople become proficient in 15 minutes."

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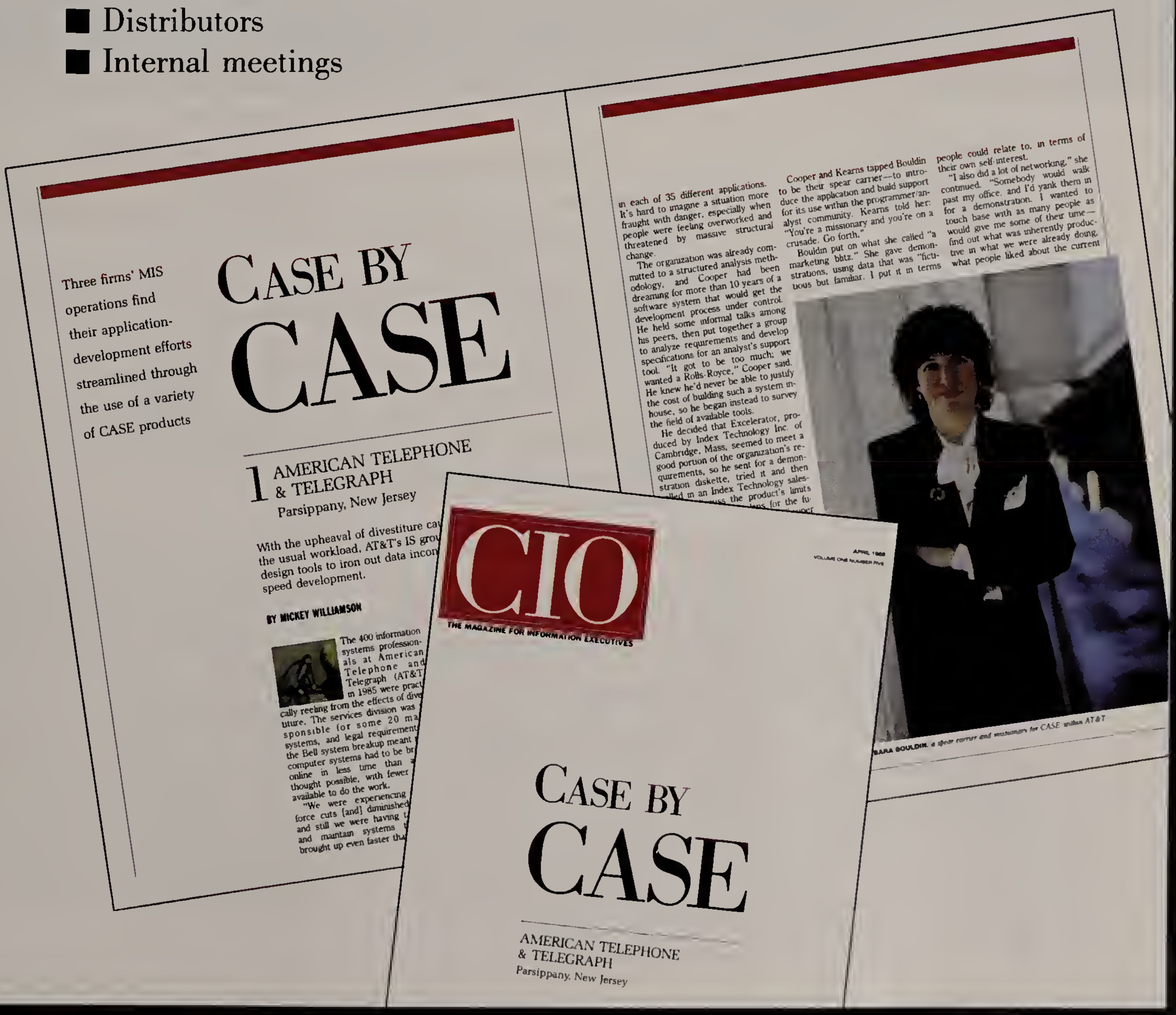

Three firms' MIS operations find their application-development efforts streamlined through the use of a variety of CASE products

CASE BY CASE

1 AMERICAN TELEPHONE & TELEGRAPH
Parsippany, New Jersey

With the upheaval of divestiture ca
the usual workload, AT&T's IS grou
design tools to iron out data incon
speed development.

BY MICKEY WILLIAMSON

The 400 information systems professionals at American Telephone and Telegraph (AT&T) in 1985 were prac
cally reeling from the effects of dive
titure. The services division was
sponsible for some 20 ma
systems, and legal requirement
the Bell system breakup meant
computer systems had to be br
online in less time than
thought possible, with fewer
available to do the work.
"We were experiencing
force cuts [and] diminished
and still we were having t
and maintain systems
brought up even faster tha

in each of 35 different applications. It's hard to imagine a situation more fraught with danger, especially when people were feeling overworked and threatened by massive structural change.

The organization was already committed to a structured analysis methodology, and Cooper had been dreaming for more than 10 years of a software system that would get the development process under control. He held some informal talks among his peers, then put together a group to analyze requirements and develop specifications for an analyst's support tool. "It got to be too much; we wanted a Rolls-Royce," Cooper said. He knew he'd never be able to justify the cost of building such a system in-house, so he began instead to survey the field of available tools.

He decided that Excelerator, produced by Index Technology Inc. of Cambridge, Mass., seemed to meet a good portion of the organization's requirements, so he sent for a demonstration diskette, tried it and then

Cooper and Kearns tapped Bouldin to be their spear carrier—to introduce the application and build support for its use within the programmer/analyst community. Kearns told her: "You're a missionary and you're on a crusade. Go forth."

Bouldin put on what she called "a marketing blitz." She gave demonstrations, using data that was "fictitious but familiar. I put it in terms people could relate to, in terms of their own self-interest.

"I also did a lot of networking," she continued. "Somebody would walk past my office, and I'd yank them in for a demonstration. I wanted to touch base with as many people as would give me some of their time—find out what was inherently productive in what we were already doing, what people liked about the current

SARA BOULDIN: a spear carrier and missionary for CASE within AT&T

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APRIL 1988
VOLUME ONE NUMBER FIVE

CASE BY CASE

AMERICAN TELEPHONE & TELEGRAPH
Parsippany, New Jersey

EVENTS

2nd International Conference on Applications of Software Measurement

Marriott's Orlando World Center, Orlando, Fla.
November 11-14
Data Processing Management Association, Education Foundation and Software Quality Engineering.
904 268-8639

This conference focuses on the use of software measurement to improve productivity. Included is a discussion of the pitfalls of software measurement and ways to shape strategies that can be used to build practitioner support. Featured are tutorials, a products and services exposition and industry speakers. Registration fees: $295-$895.

Activity-Based Costing

Atlanta Airport Hilton, Atlanta
December 2 & 3
International Quality & Productivity Center
201 783-4403 or 800 882-8684

Industry leaders discuss getting the most out of cost-accounting systems through activity-based costing. Experts share case studies on implementing ABC. Registration fee: $795.

23rd Annual EDI Users Conference and Exhibit

San Diego Marriott Hotel & Marina-Headquarters Hotel, San Diego, Calif.
December 10-12
703 838-8042
The Electronic Data Interchange Association

The theme of this conference is EDI's transition to reality. A variety of industries are represented by keynote speakers from the fields of health care, broadcasting, insurance and manufacturing. Included are general and concurrent sessions, tutorials and over 100 exhibits. Registration fees: $675-$850.

International Conference on Information Systems

Marriott Marquis Hotel, New York
December 16-18
Society for Information Management
301 738-7903

Innovation in IS research and practice is the theme. Topics discussed include object-oriented programming, IT and globalization, business value of IT and integrating AI into existing business organizations. Registration fees: $155-$630.

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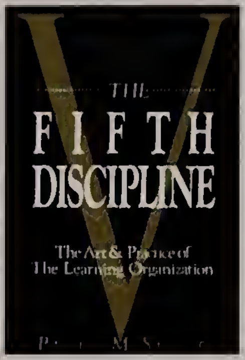
OFF THE SHELF

THE FIFTH DISCIPLINE

By Peter M. Senge
Doubleday (New York), 1990
424 pages, $19.95



The Fifth Discipline sounds like some mysterious style of kung fu or the title of a best-selling thriller. But to author Peter Senge, director of the Systems Thinking and Organizational Learning Program at MIT's Sloan School of Management, the fifth discipline is systems thinking—the "conceptual cornerstone" of five critical practices (or disciplines) for managing new organizations.

Senge adds his voice to the chorus of management gurus who sing that hierarchically fashioned organizations are Neanderthals in a world that has become fast-paced, interconnected and complex. The companies that will prosper in the future, Senge argues, are those that "discover how to tap people's commitment and capacity to learn at *all* levels of the organization." Even managers who are not building learning organizations will benefit from Senge's insights.

Organizations, like people, may suffer from "learning disabilities," Senge writes. Creative managers will want to overcome their organizations' deficiencies, and in the process leverage change to improve the company's competitiveness. Senge discusses five principles that can aid the manager: personal mastery (focusing vision and holding creative tension); mental models (identifying and improving fundamental business assumptions); building shared vision; team learning; and systems thinking—a conceptual toolset for understanding dynamic complexity.

In chapters devoted to each discipline, Senge offers managers a number of useful suggestions on how to foster growth and learning in the organization—and in the self. For instance, in a chapter on mental models, Senge discusses the mind's penchant for making leaps of abstraction (and the interpersonal friction this can cause), and the manager's need to balance inquiry and advocacy. He offers several practical tips near the end of the chapter. But he also looks at why good ideas fail in organizations, and how false models damage business.

The fifth discipline, systems thinking, informs each of the others. In the broadest respect, systems thinking is a sensibility that fosters an understanding of change, complexity and subtle interrelations; pragmatically, it is a technique for identifying problems that lie hidden in the underlying structures of the business. Although systems thinking is the hero of Senge's book, he emphasizes that all five disciplines are crucial for building learning organizations.

CYBERPUNK

By Katie Hafner and John Markoff
Simon & Schuster (New York), 1991
368 pages, $22.95

If Stephen King had been a systems manager, his bogeys might resemble the hacker "heroes" of *Cyberpunk*, a rogue's gallery of misfits, nerds and outlaws whose brilliance and sheer audacity have made them Napoleons of computer crime.

Authors Katie Hafner and John Markoff, who have covered the computer industry for a number of publications, match faces to the fingertips of three notorious hackers: Kevin Mitnick, who succeeded in breaking into the software-planning group at Digital; Pengo, part of a West German group that invaded military networks worldwide in search of information to sell to the Soviets; and Robert Morris, the Cornell graduate student whose experiment with a virus brought down the Arpanet computer network. Equal parts journalism, crime drama and cautionary tale, *Cyberpunk* explores with impressive detail the circumstances surrounding these crimes: their motivation and execution, and repercussions in the computer community.

The hackers profiled represent three very distinct types. Mitnick started his career as a "phone phreak," getting his thrills by exploring the nooks and crannies of the Bell System. His later criminal forays included stealing manuals from Pacific Bell's computer center by posing as an employee. The assaults on Digital, which eventually landed him in prison, cost that company an estimated $160,000.

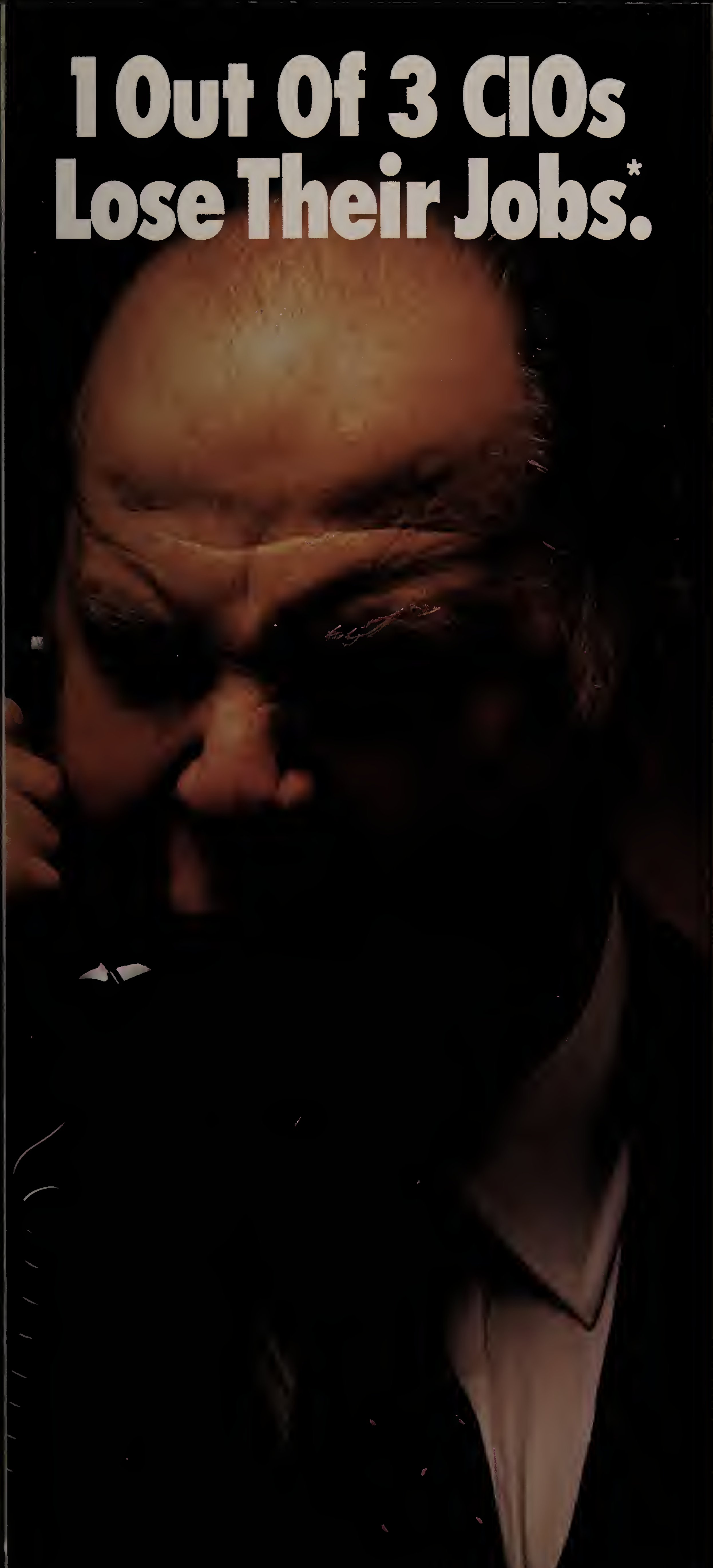
Pengo, with his spiked hair and chains, is the only true "punk" in *Cyberpunk.* A member of the notorious Chaos Computer Club, Pengo's motives for breaking into computers at Digital, Teradyne and Union Carbide, among others, were largely monetary and only vaguely political. Plus, Pengo believed he was "upholding a commitment to hacking as a thing in itself," an idea gleaned from one of William Gibson's techie science-fiction thrillers.

(It was Markus Hess, a somewhat peripheral member of Pengo's clique, who bedevilled *Cuckoo's Egg* author Clifford Stoll at the Lawrence Berkeley Laboratory in 1986. The ease with which Hess breached LBL, using it as a gateway to the computers at numerous military sites, should be a warning to anyone unconcerned about fuzzy security.)

Robert Tappan Morris is the most mundane of Hafner and Markoff's subjects. Lacking the drama of espionage or revenge, his story is that of an accident, an ambitious experiment gone awry. The soft-spoken Morris is neither a criminal nor a renegade. He simply "loved the thought of an invisible piece of software that could propel itself through an electronic universe of thousands of computers, spreading slowly and imperceptibly, achieving immortality by protecting itself against anyone who might want to destroy it."

It is this almost aesthetic appreciation of technology that elevates these three above the common pack of computer enthusiasts. But it is their obsession, and their brilliance, that make them dangerous.

1 Out Of 3 CIOs Lose Their Jobs.*



- Were they unable to communicate their strategies?
- Did they make uninformed technology decisions?
- Were they overwhelmed by the issues?

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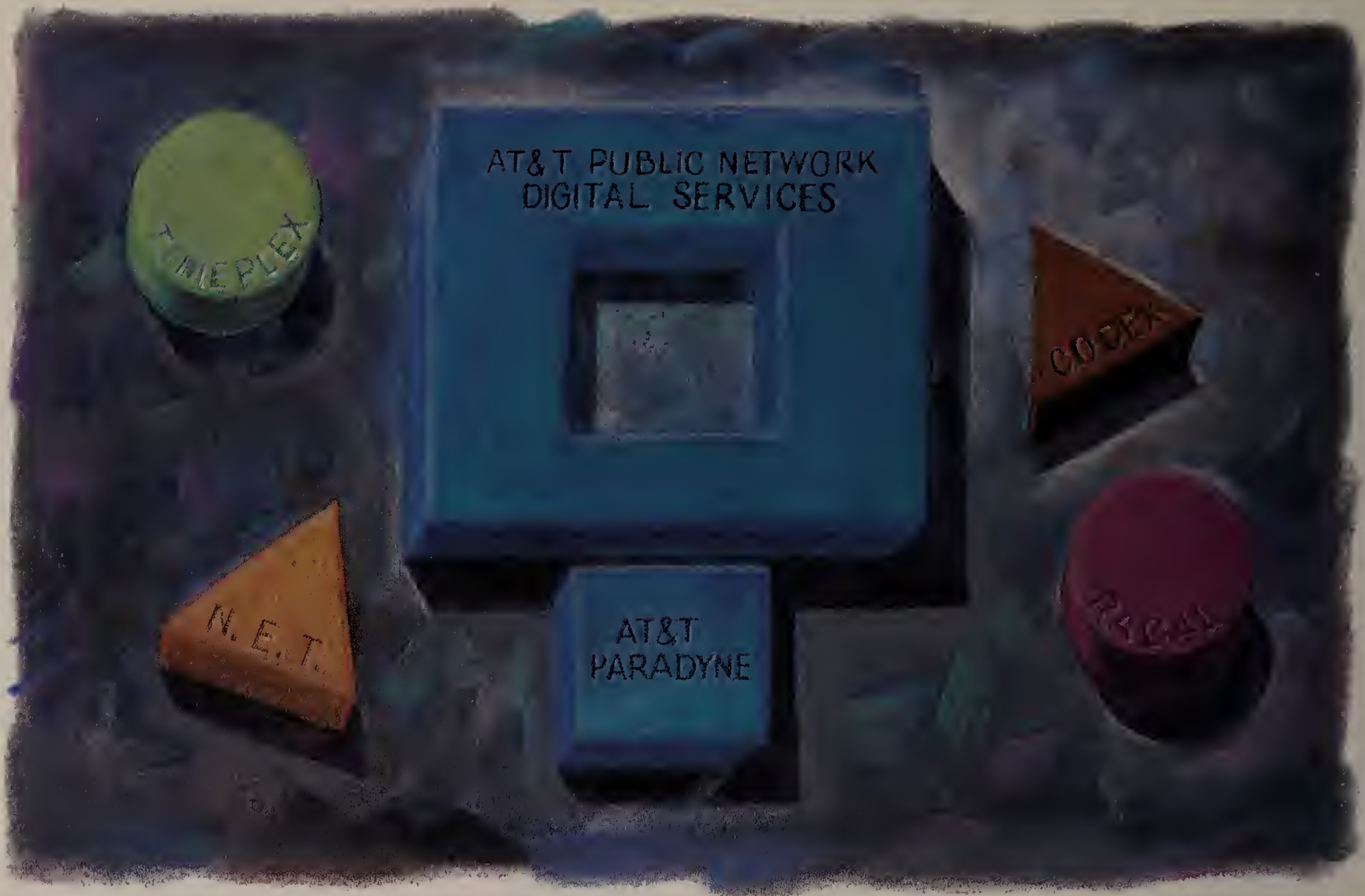

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